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[Continued on p. iii of cover]

Report of the Seventh COMMONWEALTH ENTOMOLOGICAL CONFERENCE

6th — 15th JULY, 1960

A detailed account of the Conference, together with the conclusions and resolutions arising from it, and appendices dealing with the work of the Commonwealth Institute of Entomology and the Commonwealth Institute of Biological Control.

Included in the Report are Reviews of Work in Economic Entomology in the Commonwealth, 1954–59. There are forty-seven of these Reviews, from almost all parts of the Commonwealth, and these give a comprehensive picture of the developments that have taken place in economic entomology in the various countries during the past six years. The topics dealt with include organisation and staffing, and work on insects and mites affecting agricultural and horticultural crops, forests and forest products, stored products, and, in some cases, man and stock, as well as quarantine and centralised research.

The papers given at the Open Meetings are printed in full, together with summaries of the discussions that ensued. The subjects discussed, and the opening speakers, were as follows:

Recent developments in insecticides for crop protection ..	J. T. MARTIN
Problems in the use of insecticides	A. B. HADAWAY
Hazards and precautions associated with the use of pesticides	J. M. BARNES E. J. MILLER
Research on stored-products pests and their control ..	D. W. HALL J. A. FREEMAN E. A. PARKIN & A. A. GREEN
Biological control of insects and weeds	Frank WILSON
Insect attack in relation to the physical characters and physiological state of the plant	N. D. HOLMES R. G. FENNAH
Recent investigations on timber-boring beetles	Tecwyn JONES J. D. BLECHLEY
Termite control in afforestation projects and constructional timbers	W. V. HARRIS W. A. SANDS
The utilisation of pathogenic organisms in the control of insect pests	K. M. SMITH L. L. J. OSSOWSKI
Recent advances and current trends in the study and control of tsetse flies and trypanosomiasis	J. FORD K. S. HOCKING
Developments in the study of the dispersal of insects ..	Z. V. WALOFF C. G. JOHNSON
Recent research on locusts and their control	P. T. HASKELL R. C. RAINEY
Developments in the study of plant viruses and their vectors, and their bearing on control measures	M. A. WATSON A. F. POSNETTE J. S. KENNEDY L. BROADBENT
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STEINHAUS (E. A.) & SMITH (R. F.). Ed. **Annual review of entomology. Volume 6.**—9×6 in., viii+470 pp., illus., many refs. Palo Alto, Cal., Annual Reviews, Inc., 1961.

The reviews in this sixth volume of a series [*cf. R.A.E.*, A 45 70; 48 184, etc.] comprise: **Darwin's contributions to entomology**, by J. E. REMINGTON & C. L. REMINGTON (pp. 1–12, 21 refs.); **Insect nutrition**, by H. L. HOUSE (pp. 13–26, 148 refs.); **Nutritional factors in insect resistance to chemicals**, by H. T. GORDON (pp. 27–54, 2 figs., 197 refs.); **Principles of insect cold-hardiness**, by R. W. SALT (pp. 55–74, 1 graph, 43 refs.); **The biochemistry of insect hemolymph**, by G. R. WYATT (pp. 75–102, 304 refs.); **The role of mitochondria in respiratory metabolism of flight muscle**, by B. SACKTOR (pp. 103–130, 2 figs., 119 refs.); **Diurnal rhythms**, by J. E. HARKER (pp. 131–146, 94 refs.), which is a discussion of the various kinds of diurnal rhythms that occur in the activities of insects; **The theoretical and practical study of natural insect populations**, by O. W. RICHARDS (pp. 147–162, 54 refs.); **Principles of insect predation**, by C. S. HOLLING (pp. 163–182, 1 fig., 63 refs.), which is a discussion of factors affecting the efficiency of predators; **Biological control of pest insects in Europe**, by J. M. FRANZ (pp. 183–200, 226 refs.), which is a review of the use of viruses, Protozoa, bacteria, fungi and entomophagous insects and birds for the control of insect pests of plants in various European countries; **Sampling crop pests and their hosts**, by A. H. STRICKLAND (pp. 201–220, 197 refs.); **Biology of chiggers**, by M. SASA (pp. 221–244, 114 refs.); **The phenomenon of industrial melanism in Lepidoptera**, by H. B. D. KETTLEWELL (pp. 245–262, 1 graph, 65 refs.); **A review of the phylogeny of mites**, by T. A. WOOLLEY (pp. 263–284, 1 fig., 74 refs.); **Palaeoentomology**, by O. MARTYNOVA (pp. 285–294, 142 refs.); **The analysis of insect embryogenesis**, by S. J. COUNCE (pp. 295–312, 123 refs.); **The chemistry of organic insecticides**, by T. R. FUKUTO (pp. 313–332, 1 graph, 86 refs.), which is primarily a review of the more recently developed materials; **Mode of action of insecticides**, by C. C. ROAN & T. L. HOPKINS (pp. 333–346, 78 refs.), in which the three topics discussed are symptomatology, neuro-endocrine function and intermediary metabolism; **Ecological aspects of plant virus transmissions**, by Walter CARTER (pp. 347–370, 2 figs., 142 refs.), in which insect-borne viruses of plants are considered; **Mechanism of transmission of viruses by mosquitoes**, by R. W. CHAMBERLAIN & W. D. SUDIA (pp. 371–390, 86 refs.); **Arthropod vectors as reservoirs of microbial disease agents**, by C. B. PHILIP & W. BURGDOERFER (pp. 391–412, 215 refs.); and **Transmission of filarioid nematodes**, by F. HAWKING & M. WORMS (pp. 413–432, 148 refs.).

In addition to the index to the authors whose work is reviewed and one to the subjects discussed, cumulative indexes to the reviews, classified under broad headings, and to the contributing authors in volumes 2–6 of the series are appended.

THRESH (J. M.) & LISTER (R. M.). **Coppicing experiments on the spread and control of cacao swollen-shoot disease in Nigeria.**—*Ann. appl. Biol.* 48 no. 1 pp. 65–74, 2 graphs, 27 refs. London, 1960.

The following is based on the authors' summary. A coppicing technique was used in 1954–56 to determine the incidence and distribution of latent and unrecognised infection round naturally occurring outbreaks of cacao swollen-shoot virus disease in Western Nigeria. All the apparently healthy trees within 30 yards of 80 outbreaks of various sizes were coppiced, and

most of the infected stumps that regenerated showed symptoms within a year. An equation was developed to express the distribution of infected stumps round 35 outbreaks studied in detail. The results were consistent with information on the movement of the mealybug vector, *Planococcoides* (*Pseudococcus*) *njalensis* (Laing) [cf. *R.A.E.*, A 46 417] and the spread of the virus in outbreaks. Moreover, they indicated that outbreaks are controlled most economically by removing all obviously infected trees and adjacent apparently healthy ones. Control does not require the destruction of all the trees round outbreaks up to a distance of 30 yards, as done previously, but can be achieved by felling fewer trees, the actual number depending on the size of the outbreak.

Griffiths (D. A.). **Some field habitats of mites of stored food products.**—*Ann. appl. Biol.* 48 no. 1 pp. 134-144, 3 figs., 11 refs. London, 1960.

The following is based on the author's summary. In 1956-57, 47 samples were collected from stacks of hay, grain and straw and from permanent grassland in the East Midlands of England. The living mites were extracted, and all except the Oribatei were identified. Records were kept of the occurrence of mites that are associated with stored food products, of two other mites, *Tyrophagus* (*Forcellinia*) *fungivorus* (Oudm.) and *Alliphis halleri* (Can.), which is associated with rodents, and of the beetle, *Lathridius* (*Enicmus*) *minutus* (L.).

Of the 52 species of mites identified, 22 were species associated with stored food and food stores; 21 stored-product species were collected from hay- and straw-stacks and five from grassland. *Tyroglyphus farinae* (Deg.) (*Acarus siro*, auct.), a major pest of stored cereals and cereal products, was the dominant mite in stacks and was also found in grassland samples. A species of *Tyrophagus* referred to as *T. longior* (Gerv.) (*tenuiclavus* Zkhv.) was similarly distributed and occurred almost as frequently. The motile hypopial stage of *Tyroglyphus farinae* was found in 43 per cent. of the stack samples; it was attached to mites, adults of *L. minutus* and other arthropods, and its distribution pattern resembled that of *L. minutus*. *Tyrophagus palmarum* (Oudm.), an uncommon stored-product mite, was the dominant species collected from grassland samples, and *T. fungivorus* the second most numerous; both were uncommon in stacks.

It is concluded that all the mites commonly associated with foodstuffs stored indoors are present in the outdoor habitat afforded by stacks. *Tyroglyphus farinae* and *Tyrophagus longior* are dominant in stacks and both appear to be field dwellers. *T. palmarum* appears to be a successful field dweller, and its occasional association with stored food may be accidental. The dominant warehouse partnership of *Tyroglyphus farinae* and *Glycyphagus destructor* (Schr.) does not occur outdoors, where *Tyrophagus longior* replaces *G. destructor*. Glycyphagids appear to live mainly in haystacks situated in stackyards. Grain-stacks standing in the open field have a peculiar combination of dominant species, comprising *Tyroglyphus farinae*, *Tyrophagus longior*, *T. palmarum* and *Alliphis halleri*.

Raw (F.). **Field studies on wheat-bulb fly infestations.**—*Ann. appl. Biol.* 48 no. 1 pp. 145-155, 7 refs. London, 1960.

The following is virtually the author's summary. An account is given of two experiments done on commercial farms in Essex to study the effect

of tilth, cultivation and seed rate on the infestation of wheat by the wheat-bulb fly [*Hylemyia coarctata* (Fall.)] and the effect of infestation on yield. Heavier infestations developed on rough fallows and those cultivated during the oviposition period than on smooth fallows and those not cultivated during the oviposition period. These results confirmed those of an earlier experiment done at Rothamsted. At each level of infestation, more larvae survived on plots sown at 3 bushels per acre than on plots sown at $\frac{3}{2}$ or 1 bushel per acre. Although some plots had a high larval population, no effect of infestation on yield was observed, even at the lower seed rates. This is attributed to early sowing. The extent to which the cultural treatments studied can be used to control infestation by *H. coarctata* is discussed.

FIDLER (J. H.) & WEBLEY (D.). *Oscinella frit* L. in South Wales. The relationship between sowing date, plant development and progress of attack in spring oats.—*Ann. appl. Biol.* 48 no. 1 pp. 156–176, 6 graphs, 23 refs. London, 1960.

The following is virtually the authors' summary. The degree of lateness of sowing of spring oats in South Wales is reflected in a proportional increase of damage by *Oscinella frit* (L.) to the shoots. Late-sown crops are also more subject to heavy attacks on the grain than those sown earlier. Equations are given relating the development of attack both to the growth of the plant and to the date of sowing.

SMITH (H. J.). Detection and estimation of the biologically active constituents of pyrethrum.—*J. Sci. Fd Agric.* 11 no. 3 pp. 172–176, 2 graphs, 9 refs. London, 1960.

The following is the author's summary. A method is described for the determination of cinerin I, pyrethrin I, cinerin II, and pyrethrin II in pyrethrum preparations based upon quantitative preparation and chromatographic separation of their 2,4-dinitrophenylhydrazones. The method is rapid and is suitable for routine analysis.

BLACKITH (R. E.) & LUBATTI (O. F.). The influence of oil content on the susceptibility of seeds to fumigation with methyl bromide.—*J. Sci. Fd Agric.* 11 no. 5 pp. 253–258, 2 graphs, 11 refs. London, 1960.

The following is the authors' summary. Evidence for the greater susceptibility of seeds of higher oil content to methyl bromide is reviewed. Oils increase the sensitivity of seeds to the fumigant at higher moisture contents by making the water more readily available, probably by blocking sorptive substrates. The oil may also act as a reservoir for methyl bromide, so that oily seeds are subject to more severe delays during germination than are less oily seeds. The conditions of moisture content and dosage under which the oily seeds, carrot, rape, cabbage and radish, may be treated, are established, as is the range of oil contents in lucerne, a seed not subject to selection for this character.

DONALDSON (J. M.) & STEVENSON (J. H.). **The stabilising effect of piperonyl butoxide on pyrethrins exposed to ultra-violet light.**—*J. Sci. Fd Agric.* **11** no. 7 pp. 370–373, 8 refs. London, 1960.

Since piperonyl butoxide has a negligible effect on the toxicity of pyrethrins to adults of *Cadra (Ephesia) cautella* (Wlk.) [cf. *R.A.E.*, A **48** 241], this moth was selected for tests, which are described, of a possible stabilising effect of the synergist on pyrethrins during irradiation with ultraviolet light [cf. B **47** 69]. No such stabilisation was demonstrated.

PARKIN (E. A.) & LLOYD (C. J.). **Selection of a pyrethrum-resistant strain of the grain weevil, *Calandra granaria* L.**—*J. Sci. Fd Agric.* **11** no. 8 pp. 471–477, 18 refs. London, 1960.

The following is virtually the authors' summary. Adults of a field strain of the grain weevil, *Sitophilus (Calandra) granarius* (L.), initially twice as resistant to pyrethrins in oil solution as a laboratory standard strain, were exposed to selection pressure with pyrethrins in 17 out of 22 generations in the course of five years. The strain steadily increased in resistance to pyrethrins and is now 18 times as resistant as the standard. There was a simultaneous increase in resistance to pyrethrins synergised with piperonyl butoxide of only $\times 2$. In the course of selection, the beetles of the resistant strain became heavier in weight, but not sufficiently to account for the resistance. They also became darker in colour, but this change was shown to be physiologically unconnected with the increase in resistance to pyrethrins.

JAMESON (H. R.). **γ -BHC liquid seed dressing for the control of turnip flea beetle.**—*J. Sci. Fd Agric.* **11** no. 9 pp. 528–534, 3 refs. London, 1960.

The following is virtually the author's summary. Viscous aqueous seed dressings containing up to 16 per cent. γ BHC, prepared for use as seed dressings against flea-beetles [*Phyllotreta*] on turnips and kale in Britain, did not impair germination when applied at 50 ml. per lb. of seed. The dressed seed dried quickly, was not dusty and was ready for drilling in about half an hour. In field experiments, one of these dressings, containing only 4 per cent. γ BHC, was highly effective in controlling flea-beetles on kale seedlings, even against attack occurring up to three weeks after the seed was sown.

DAVATCHI (A.), TAGHI-ZADEH (F.) & SAFAVI (M.). **Contribution à l'étude biologique et économique des coléoptères phytophages et xylophages de l'Iran. (Première note.)**—*Rev. Path. vég.* **38** fasc. 4 pp. 235–252. Paris, 1959. (With a summary in English.)

Notes are given on the occurrence and habits of various Longicorns, Buprestids and Lamellicorns that injure fruit or other trees or plants in Persia, either as primary or as secondary pests.

NARAYANAN (E. S.), SUBBA RAO (B. R.) & CHACKO (M. J.). ***Aholcus euproctiscidis* Mani (Scellionidae: Hymenoptera), an egg parasite of *Euproctis lunata* Walker.**—*Proc. Indian Acad. Sci. (B)* **49** no. 1 pp. 74–81, 2 figs., 11 refs. Bangalore, 1959.

Telenomus (Aholcus) euproctiscidis (Mani) is an important egg-parasite of *Euproctis lunata* Wlk., which severely infests castor [*Ricinus communis*]

throughout India. Investigations on its bionomics showed that the adults paired soon after emergence, and oviposition took place during August–October, when the population of *E. lunata* is at its height. The females laid their eggs in fresh host eggs, as a rule singly, but only one individual completed its development even when more than one egg was deposited. The larvae hatched in 1–2 days, and the three instars lasted 2–3, 1 and 2 days, respectively. Pupation took place in the egg, and the pupal stage lasted 6–8 days. The duration of the life-cycle varied from 12 days in September (maximum temperature 88°F., minimum temperature 77.5°F.) to 15–16 days in November (maximum temperature 78°F., minimum temperature 71°F.). The immature stages are described.

ABRAHAM (E. V.). **Killer insects of cashew.**—*Indian Fmg* 9 no. 3 pp. 14–15, 5 figs. New Delhi, 1959.

The principal insect pests of cashew [*Anacardium occidentale*] on the western coast of India are *Helopeltis antonii* Sign., *Hypatima* (*Chelaria*) *haligramma* (Meyr.), *Ferrisia virgata* (Ckll.) and *Toxoptera odinae* (v. d. Goot). Their habits and control are reviewed.

SUBRAMANIAN (T. R.). **The biology of the weevil *Alcidodes bubo* (Fabricius) (Coleoptera: Curculionidae).**—*J. Bombay nat. Hist. Soc.* 56 no. 1 pp. 82–94, 2 pls., 17 refs. Bombay, 1959.

Sesbania grandiflora, which is grown in southern India for fodder, green manure and other purposes, is severely infested by *Alcidodes bubo* (F.). The distribution and food-plants of this weevil [*cf. R.A.E.*, A 6 47; 10 399] are reviewed, and all stages are described. Observations in Coimbatore showed that the females laid their eggs in excavations in the tender shoots and stems, as a rule singly, beginning 6–13 days after emergence; 18–166 eggs were laid per female during an oviposition period of 9–82 days. On *Sesbania*, which is sown in July, oviposition began in August and continued for as long as the crop was left in the field. The duration of adult life in captivity ranged from 37 to 98 days for males and 29 to 84 days for females with food and from 4 to 10 and 5 to 12 days, respectively, without. The larvae bored in the stems, making irregular galleries and caused uneven growth, swelling and stunting. The damage was severe in young plants, occasionally resulting in death. Pupation took place in the larval burrow, and the egg, larval and pupal stages lasted 6–7, 34–40 and 9–11 days, respectively. There was no definite period of hibernation, and all stages occurred together in the field. Low parasitism of the larvae by unidentified species of *Pristomerus*, *Ipoobracon* and *Pseudocatolaccus* was observed.

MURTHY (D. V.). **Some leaf-miners of agricultural importance in Nizamabad district of Andhra Pradesh.**—*J. Bombay nat. Hist. Soc.* 56 no. 1 pp. 151–154, 3 refs. Bombay, 1959.

The leaves of rice in the Nizamabad district of Andhra Pradesh are mined by *Ricladispa* (*Hispa*) *armigera* (Ol.), *Pseudonapomyza atra* (Mg.) and *Rhadinosa lebongensis* Mlk. The habits and natural enemies of these insects are reviewed.

GUPTA (B. D.). **An analysis of factors underlying heavy incidence of the stalk borer (*Chilo traea auricilia* Ddgn.) in sugarcane.**—*Indian Sug.* 8 no. 3 pp. 209–210, 217–218, 221–223, 2 figs., 1 ref. Cawnpore, 1958.

Infestation of sugar-cane by *Chilo traea auricilia* (Dudgn.) in Lucknow, India, was very low in 1956 but extremely high, reaching 95 per cent., in 1957. An investigation of the causes of heavy infestation showed that conditions created by drought at the time of mass emergence and oviposition resulted in unusually heavy egg-laying during the third–fifth generations. Conditions in water-logged fields proved very favourable for the growth and survival of the larvae, and lodging as a result of water-logging greatly increased the infestation. Heavy manuring should be avoided in fields liable to flooding and prolonged water-logging, as 100 lb. or more nitrogen (as ammonium sulphate) per acre made the canes soft, succulent and liable to greater borer injury.

FERNANDO (H. E.) & MANICKAVASAGAR (P.). **Investigations on potato insects and their control with special reference to *Dorylus orientalis*.**—*Trop. Agriculturist* 114 (1958) no. 2 pp. 127–139, 2 figs., 4 refs. Colombo [1959].

Potatoes cultivated experimentally in Ceylon in 1952–54 were infested by a root-eating ant (*Dorylus orientalis* Westw.), *Gnorigmoschema operculella* (Zell.), a leafhopper (probably *Empoasca fabae* (Harris)), *Agrotis ypsilon* (Hfn.) and, to a less extent *Myzus persicae* (Sulz.) and a root-eating termite. A survey at five places in 1956–57 showed that *D. orientalis* and *A. ypsilon* were the most destructive, and experiments on their control were begun. *A. ypsilon* was well controlled by diluting a 20 per cent. endrin, aldrin or chlordane emulsion concentrate to 1 fl. oz. in 10 gal. water and pouring 400 cc. of this down the main stem of each plant into the soil. The ant was not numerous in 1957, and good control was obtained by watering the planting sites at sprouting, or at sprouting and tuber formation, with 400 cc. liquid prepared by diluting 20 per cent. emulsion concentrates of dieldrin, aldrin or chlordane to 1 fl. oz. in 5 or 20 gal. water, though chlordane tainted the tubers; similar treatments with DDT were less effective. The treatments were tested further at two localities in 1958, chlordane being omitted, and the liquids were poured into the soil along the basal parts of the stem. Aldrin gave the best results, followed by dieldrin and DDT. At one place, treatment with aldrin concentrate at 1 fl. oz. per 5 gal. at sprouting and tuber formation resulted in only 0.86 per cent. damaged tubers, as compared with 33.87 per cent. for the untreated plants.

NISHIO (Y.) & IMABAYASHI (S.). **The population-prevalence of *Panonychus ulmi* Koch affected by some new acaricides in an orchard.** [In Japanese.]—*Jap. J. appl. Ent. Zool.* 2 no. 3 pp. 171–178, 3 graphs, 18 refs. Tokyo, 1958. (With a summary in English.)

Panonychus ulmi (Koch) is a serious pest of fruit trees in Hokkaido, and the relation of toxicants to its control by natural enemies was investigated in 1956. Sprays of oil emulsion, DDT, BHC and parathion were each applied to one apple tree, and one was left untreated. On the tree sprayed with DDT, the mite population became high in mid-July and remained so until mid-August, when damage was severe and the population began to decline; few winter eggs were found in September–October. The population

was lower throughout the summer on the unsprayed tree, but some injury was caused and some winter eggs were laid. The population remained low on the trees receiving the other treatments until mid-August, after which there was a rapid increase, with heavy deposition of winter eggs. Predators were scarce until August, but some were present on the DDT-treated and the untreated tree in autumn, though this was too late for effective control. The increase on the other trees appeared to be due more to the favourable condition of the foliage than to destruction of natural enemies. The cause of the great increase in summer population on the DDT-sprayed tree was unknown [cf. *R.A.E.*, A 45 336, etc.].

KONO (T.) & SUGINO (T.). **On the estimation of the density of rice stems infested by the rice stem borer.** [In Japanese.]—*Jap. J. appl. Ent. Zool.* 2 no. 3 pp. 184–188, 3 graphs, 9 refs. Tokyo, 1958. (With a summary in English.)

A method of calculating the number of rice stems infested by *Chilo suppressalis* (Wlk.) from the number of infested rice hills is described. It is based on data collected over several years in western Japan, and saves much labour.

MATSUMOTO (S.) & KUROSAWA (T.). **Notes on a new host-plant of the soy-bean pod borer, *Grapholitha glycinivorella* Matsumura.** [In Japanese.]—*Jap. J. appl. Ent. Zool.* 2 no. 3 pp. 189–191, 2 figs., 4 refs. Tokyo, 1958. (With a summary in English.)

Arrowroot (*Pueraria lobata*), which grows in mountainous country in Hokkaido, was found to be a wild food-plant of *Cydia* (*Grapholitha*) *glycinivorella* (Mats.), an important pest of soy bean.

ISHII (S.) & HIRANO (C.). **Effect of fertilizers on the growth of the larva of the rice stem borer, *Chilo suppressalis* Walker. I. Growth response of the larva to the rice plant cultured in different nitrogen level soils.** [In Japanese.]—*Jap. J. appl. Ent. Zool.* 2 no. 3 pp. 198–202, 1 graph, 8 refs. Tokyo, 1958. (With a summary in English.)

Nitrogenous fertilisers applied to rice were found in experiments in Japan to favour the growth of the larvae of *Chilo suppressalis* (Wlk.).

TAMURA (I.) & SUZUKI (T.). **Studies on the varietal difference in plant to the injury of insects by breeding in the stage of seedlings. I. On the test of insect resistance of rice plant varieties to rice stem maggot, *Chlorops oryzae* Matsumura.** [In Japanese.]—*Jap. J. appl. Ent. Zool.* 2 no. 3 pp. 208–214, 4 graphs, 8 refs. Tokyo, 1958. (With a summary in English.)

A method of rearing *Chlorops oryzae* Mats. on a wild grass from field-collected adults and of infesting rice with the larvae is described. It can be used for testing the resistance of rice varieties to infestation at any time of year.

HIRAO (J.) & HASEGAWA (T.). **Studies on the wheat stem fly, *Chlorops* sp. (Dipt., Chloropidae) (preliminary report).** [In Japanese.]—*Jap. J. appl. Ent. Zool.* **2** no. 3 pp. 215–222, 1 pl., 2 figs., 7 refs. Tokyo, 1958. (With a summary in English.)

An unidentified species of *Chlorops* was found infesting wheat in Akita Prefecture in the autumn of 1955. Observations on its morphology and bionomics and the injury caused are described. It had two generations a year, and the larvae damaged the leaves and stems; rye was also infested.

NISHIGAKI (J.). **The effects of the water content of rice and the temperature on the development and the reproductive rate of the geographical strains of the two rice weevils, *Calandra oryzae* L. and *C. sasakii* Takahashi.** [In Japanese.]—*Jap. J. appl. Ent. Zool.* **2** no. 4 pp. 264–270, 3 graphs, 13 refs. Tokyo, 1958. (With a summary in English.)

Observations using four strains of *Sitophilus* (*Calandra*) *oryzae* (L.), from Japan, Australia, Indonesia and Missouri, and four of *S. (C.) sasakii* (Tak.), from Japan, Australia, Nepal and Canada, showed that the velocity of development and the rate of reproduction increased in general as the water content of the rice was increased from 12.2 to 16.7 per cent. Development at 20, 25 and 30°C. [68, 77 and 86°F.] was slightly slower for *S. sasakii* than for *S. oryzae*. The theoretical threshold of development was lower for *S. oryzae*, but the sum of effective temperatures required was higher. The rate of reproduction with increase of temperatures between 25 and 30°C. decreased for *S. oryzae* and increased for *S. sasakii*. The duration of development was longer for males than for females in *S. oryzae*, but shorter in *S. sasakii*, except at 30°C.

KOJIMA (K.), NAGAE (Y.), ISHIZUKA (T.) & SHIINO (A.). **The penetration and metabolism of *pp'*-DDT in the DDT-resistant common cabbage worm and the DDT-susceptible cabbage armyworm.** [In Japanese.]—*Botyu-Kagaku* **23** pt. 1 pp. 12–22, 4 graphs, 46 refs. Kyoto, 1958. (With a summary in English.)

DDT has been widely used in Japan since 1948 against Lepidopterous larvae on cabbage and at first controlled both *Pieris rapae* (L.) and *Mamestra* (*Barathra*) *brassicac* (L.). In 1953, however, it failed against the former in two areas, and laboratory tests by topical application in acetone showed that the LD50 was as high as 353 µg. *p,p'*-DDT per g. for fourth-instar larvae, as compared with only 0.15 for *B. brassicae*. Further tests indicated that penetration of the insecticide was the same for the two species, but that metabolism to DDE occurred rapidly in the resistant larvae and not in the others. Penetration of topically applied DDE was also similar; it was metabolised slowly in both species, but rather more rapidly in the resistant than in the susceptible larvae. Cross-resistance to some other insecticides was also noted.

INOUE (M.) & NOBUCHI (A.). **Studies on the natural enemies of the bark beetles and borers (I).** [In Japanese.]—*Spec. Rep. Hokkaido Br. Govt For. Exp. Sta.* no. 8 pp. 190–204, 16 figs., 25 refs. Sapporo, 1957. (With a summary in English.)

A storm in May and a typhoon in September 1954 caused extensive damage in coniferous forests in Hokkaido, Japan. The fallen trees were

heavily infested by bark-beetles and borers, and these were attacked by insect parasites and predators. The principal predators were *Thanasimus substriatus* (Geb.), *Temnochila japonica* Rtt. and *Metoponcus maximus* Bernhauer, which afforded considerable control, and their mature larvae are described and figured.

NISHIJIMA (Y.). **Host plant preference of the soybean pod borer, *Grapholitha glycinivorella* Matsumura (Lep., Eucosmidae). 1. Oviposition site.**—*Ent. exp. appl.* **3** no. 1 pp. 38–47, 2 figs., 22 refs. Amsterdam, 1960. (With a summary in German.)

The following is based on the author's summary. The oviposition preferences of *Cydia* (*Grapholitha*) *glycinivorella* (Mats.), an important factor in the resistance of the soy-bean plant to attack, were studied in the field in Japan in 1952–53, two hairy and two glabrous varieties being used. It was found that there was a considerable difference in the number of eggs laid on the hairy and glabrous varieties, and also in the place where the eggs were laid. These differences were observed even when the hairy varieties were planted alternately with the glabrous ones. However, there was no difference in the number of eggs laid when all the pods were removed from the plants. This treatment of the hairy varieties caused a great decrease in the number of eggs laid, whereas there was no difference on the glabrous varieties. These observations suggest that there is not only a varietal preference but also a site preference within plants, hairy pods being the most attractive oviposition sites.

IBBOTSON (A.). **Observations on the oviposition behaviour of frit fly (*Oscinella frit* L. Dipt. Chloropidae).**—*Ent. exp. appl.* **3** no. 1 pp. 84–92, 3 figs., 6 refs. Amsterdam, 1960. (With a summary in German.)

The experiments described were carried out in the laboratory on oats or artificial oat shoots and indicated that oviposition by *Oscinella frit* (L.) is stimulated by a component (probably biochemical) originating from the plant itself and one resulting from a particular disposition of legs and ovipositor, not necessarily dependent on the presence of a plant.

STRONG (R. G.) & LINDGREN (D. L.). **Germination of cereal, sorghum, and small legume seeds after fumigation with hydrogen phosphide.**—*J. econ. Ent.* **53** no. 1 pp. 1–4, 4 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. Since phosphine (hydrogen phosphide) is effective as a fumigant against several insect pests of stored grain [cf. *R.A.E.*, **A** **48** 127, etc.], its effect on germination was tested. The seeds of various cereals, Sudan grass [*Sorghum sudanense*] and leguminous fodder plants were dried to the desired moisture contents and fumigated by placing weighed portions of Phostoxin tablets, containing aluminium phosphide [and ammonium carbamate (cf. *loc. cit.*)] on top of sample bags in a fumigation chamber. Treatment for a week at 50, 70 or 90°F. with 9 or 18 mg. phosphine per litre did not affect germination, even when carried out twice.

MASON (H. C.) & HENNEBERRY (T. J.). *Drosophila* breeding in refuse from tomato canneries.—*J. econ. Ent.* 53 no. 1 pp. 8–11, 4 figs., 4 refs. Menasha, Wis., 1960.

The following is substantially the authors' abstract. Surveys made in 1953–55 on the Eastern Shore of Maryland to determine the effect of methods of disposing of refuse from tomato canneries on breeding by *Drosophila* [cf. *R.A.E.*, A 48 69] showed that very little breeding occurred when the refuse was spread thinly over a field with a manure spreader, whereas refuse dumped in truckload piles or pumped from the cannery into shallow pits was sometimes a source of infestation in neighbouring canneries and fields. *D. melanogaster* Mg., *D. buscki* Coq., *D. hydei* Sturt. and *D. transversa* Fall. were found breeding in the refuse.

STRONG (R. G.) & LINDGREN (D. L.). Effect of methyl bromide and hydrocyanic acid fumigation on the germination of flax seeds.—*J. econ. Ent.* 53 no. 1 pp. 17–19, 7 refs. Menasha, Wis., 1960.

Two varieties of flax seed with moisture contents adjusted to 6–12 per cent. were fumigated for 72 hours with various dosages of methyl bromide, and one of them with methyl bromide and hydrogen cyanide for various periods and dosages, at temperatures of 50, 70 or 90°F. in gas-tight chambers 100 cu. ft. in capacity. Half the samples were fumigated once and half twice, and germination tests were made within five days of fumigation and after storage at 50°F. for 84 days [cf. *R.A.E.*, A 48 467, etc.]. Fumigation with 2–3 lb. HCN per 1,000 cu. ft. for 72 hours caused no damage, but methyl bromide, tested at 1–4, 1·5–5, 1·5–4, 2–6 and 3–6 lb. for 72, 48, 24, 8 and 2 hours, respectively, reduced germination under some conditions. Variety of seed and post-fumigation storage were of no importance, but temperature, moisture content, dosage, period of exposure and repetition of treatment all probably affected the amount of injury, though their relative importance could not be determined, owing to the erratic nature of the results.

JOHNSEN (R. E.), DAHM (P. A.), RUSK (H. W.), FAIRCHILD (M. L.) & FREEMAN (A. E.). Heptachlor residues on corn stover in relation to dairy cattle feeding.—*J. econ. Ent.* 53 no. 1 pp. 19–22, 12 refs. Menasha, Wis., 1960.

Late-sown maize near Ankeny, Iowa, was treated with 20 lb. 5 per cent. heptachlor granules per acre on 11th July 1957, when it was in the late whorl stage, for the control of *Ostrinia* (*Pyrausta*) *nubilalis* (Hb.). Plants picked 1, 4 and 8–102 days later contained 1·44, 0·55 and less than 0·01 parts per million heptachlor and 0·03–0·15 p.p.m. heptachlor epoxide [cf. *R.A.E.*, A 47 57]; samples of stover, collected from the field 120 days after treatment, showed no heptachlor residues. Dairy cows were pastured in the field after harvest, 13 days after the last sample collection, and butter made from the milk showed no sign of insecticide residue by colorimetric analysis. It is concluded that no heptachlor epoxide was secreted in the milk.

ANDERSON (L. D.) & REYNOLDS (H. T.). **A comparison of the toxicity of insecticides for the control of corn earworm on sweet corn.**—*J. econ. Ent.* **53** no. 1 pp. 22–24, 1 fig., 5 refs. Menasha, Wis., 1960.

In 1949–58, 69 dust formulations were tested for the control of *Heliothis zea* (Boddie) on sweet maize in southern California. The dusts were applied to the silks with a paint brush 3–4 times at intervals of three days, beginning within a day after the first few ears began silking, and the results, which are given in a table, showed that 2 per cent. Sevin, Thiodan or endrin, 3 per cent. heptachlor and 5 per cent. trichlorphon (Dipterex) were slightly better than the standard treatment of 5 per cent. DDT; 1 per cent. isodrin, 2 per cent. Compound 25141 (O,O-diethyl O-p-methylsulphinyphenyl phosphorothioate), SD 4402 (1,3,4,5,6,7,8,8-octachloro-3a,4,7,7a-tetrahydro-4,7-methanophthalan) or diazinon, 5 per cent. malathion or azinphos-methyl (Guthion) and 10 per cent. UCC 8305 (P-chloro-2,4-dioxas-5-methyl-P-thiono-3-phosphabicyclo(4.4.0)decane) were rather less effective, and all other treatments gave relatively poor results.

KRUEGER (H. R.), O'BRIEN (R. D.) & DAUTERMAN (W. C.). **Relationship between metabolism and differential toxicity in insects and mice of diazinon, dimethoate, parathion, and acethion.**—*J. econ. Ent.* **53** no. 1 pp. 25–31, 4 graphs, 11 refs. Menasha, Wis., 1960.

The following is based partly on the authors' abstract. The persistence and metabolism of diazinon, dimethoate and acethion (O,O-diethyl S-ethoxycarbonylmethyl phosphorodithioate), which are much more toxic to insects than to mammals, and of parathion, which is not, were studied in mice, *Periplaneta americana* (L.) and *Musca domestica* L. The results are considered to indicate that the selective toxicity of the first three is due to high levels of the oxygen analogue in the susceptible species for diazinon and to the persistence of unaltered parent compound in them for dimethoate and acethion. The differences found in the absorption and metabolism of diazinon by normal house-flies and those resistant to it were small. Parathion treatment resulted in higher levels of paraoxon (the oxygen analogue) in the insects than in mice, without a corresponding difference in toxicity.

LIPKE (H.) & KEARNS (C. W.). **DDT-dehydrochlorinase. III. Solubilization of insecticides by lipoprotein.**—*J. econ. Ent.* **53** no. 1 pp. 31–35, 2 graphs, 23 refs. Menasha, Wis., 1960.

The use of DDT-dehydrochlorinase with lipoprotein-solubilised DDT is described as an example of solubilisation techniques in the metabolic study of insecticides *in vitro*.

BRAZZEL (J. R.) & HIGHTOWER (B. G.). **A seasonal study of diapause, reproductive activity and seasonal tolerance to insecticides in the boll weevil.**—*J. econ. Ent.* **53** no. 1 pp. 41–46, 1 graph, 8 refs. Menasha, Wis., 1960.

The following is substantially the authors' abstract. A seasonal study of the reproductive activity, incidence of diapause and seasonal tolerance to toxaphene and azinphos-methyl (Guthion) of *Anthonomus grandis* Boh. was carried out in four cotton fields in central Texas in 1958. Adults in diapause

were first found between late July and late August and occurred in all subsequent collections. Reproductive activity was high from June until the onset of diapause and again in September, when rainy weather resulted in considerable regrowth of cotton. Overwintered weevils that emerged early in the season and had a fat content of more than 10 per cent. of their dry weight were harder to kill with toxaphene than weevils of the current season, collected during June and early July, but, with the onset of diapause in late July and August, tolerance to toxaphene became 100 times as great within two weeks. No evidence was found of seasonal tolerance to azinphos-methyl.

GETZIN (L. W.) & CHAPMAN (R. K.). **The fate of phorate in soils.**—*J. econ. Ent.* **53** no. 1 pp. 47–51, 2 graphs, 9 refs. Menasha, Wis., 1960.

The following is based largely on the authors' abstract. Investigations were carried out on the hydrolysis, oxidation, insecticidal efficiency, persistence and degree of binding of phorate in three types of soil and quartz sand. When applied as a soil treatment in the field, it was more available to cabbage and potatoes grown in a sandy soil than in a clay-loam soil, as indicated by insect control and anticholinesterase assay, and measurement of phorate, labelled with ^{32}P , when taken up by peas showed that most was taken from quartz sand and progressively less from sandy soil, clay loam and muck.

Extraction, column chromatographic and partitioning techniques showed that phorate applied to soil is partly oxidised, hydrolysed and bound to the soil. The radioactive compounds extracted with chloroform 7, 14 and 28 days after application of radioactive phorate were identified as phorate and a mixture of its sulphoxide and sulphone. Only very small amounts could be identified as hydrolysis products, and a large part remained bound to the soil and could not be identified. Radioactive phorate added to sand was rapidly hydrolysed, but no oxidation products were detected.

A study of phorate volatilisation from soil showed that the sandy soil, silt loam and muck lost 25, 20 and 18 per cent., respectively, of the radioactive material applied within an hour, but little or none later; radioactive phorate was lost rapidly from quartz sand and a steel surface, less than 10 per cent. remaining after 24 hours.

PARENCIA jr. (C. R.) & COWAN jr. (C. B.). **Increased tolerance of the boll weevil and cotton fleahopper to some chlorinated hydrocarbon insecticides in central Texas in 1958.**—*J. econ. Ent.* **53** no. 1 pp. 52–56, 11 refs. Menasha, Wis., 1960.

The following is substantially the authors' abstract. *Anthonomus grandis* Boh. and *Psallus seriatus* (Reut.) showed increased tolerance for several chlorinated hydrocarbon insecticides in central Texas in 1958. Topical application of insecticides to adults of *A. grandis* reared from cotton squares collected from one field in July showed that they had an increased tolerance for toxaphene and a high tolerance for dieldrin. In field experiments with sprays, much better control was obtained with Sevin and organic phosphates (azinphos-methyl (Guthion) and malathion) than with these materials. Dosages of toxaphene, dieldrin and heptachlor 2–3 times as great as those effective in previous years failed to control *P. seriatus*, whereas Sevin, azinphos-methyl, malathion and DDT, the last alone or with toxaphene or dieldrin, were effective; DDT had not been used against *P. seriatus* for ten years in the area.

ANDERSON (L. D.) & GUNTHER (F. A.). **Nicotine residues in field-treated cauliflower, celery, green beans, kale, mustard greens and spinach.**—*J. econ. Ent.* **53** no. 1 pp. 64–65, 1 ref. Menasha, Wis., 1960.

Since nicotine residues on Texas mustard greens grown near Los Angeles were responsible for 40 cases of violent illness in 1954, various crops were examined for residues after treatment in 1955–56 [*cf. R.A.E.*, A **48** 367]. The results showed that normal sprays of nicotine sulphate (Black Leaf 40) left no appreciable residues on green beans, celery or cauliflower curds and only slight residues that disappeared in 1–4 days on cauliflower leaves. Kale and spinach, treated with about 50 U.S. gal. spray containing 2 U.S. pints Black Leaf 40 per acre, retained moderate residues for about a week, but Texas mustard greens treated with half this dosage or with 30 lb. 3 per cent. nicotine dust per acre had appreciable residues after nearly two weeks.

MORRIS (R. F.). **Control of root maggots in swede turnips in Newfoundland with heptachlor and aldrin and the effect on parasites and overwintering pupae.**—*J. econ. Ent.* **53** no. 1 pp. 65–67, 3 refs. Menasha, Wis., 1960.

The following is based largely on the author's abstract. Root maggots, mainly *Hylemyia brassicae* (Bch.), cause severe damage to swedes in parts of Newfoundland, and heptachlor and aldrin in granules applied in the furrow were tested for their control in 1955–57. Doses of 2, 3 and 4 lb. actual heptachlor per acre gave averages of 78, 88 and 89 per cent. control and 2, 3, 4 and 5 lb. aldrin averages of 63, 71, 76 and 79 per cent. over the three years, and the two compounds increased the percentages of marketable roots from 29–40 to 91–100 and 80–98, respectively. The treatments apparently caused some mortality of overwintering pupae as well as of the larvae, but eliminated *Aleochara bilineata* Gylh. and reduced parasitism of the pupae by *Trybliographa rapae* (Westw.) from 9 to less than 2 per cent. The number of overwintering pupae found in the soil round the roots at harvest in October was closely correlated with the amount of damage caused by the larvae and could be used to measure the effect of the treatments.

STERN (V. M.), VAN DEN BOSCH (R.) & REYNOLDS (H. T.). **Effects of Dylox and other insecticides on entomophagous insects attacking field crop pests in California.**—*J. econ. Ent.* **53** no. 1 pp. 67–72, 11 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. In field tests in California in 1957–58, sprays were applied to lucerne when it was 12–24 in. high, to determine the relative toxicities of various insecticides to beneficial insects. Trichlorphon (Dylox) was toxic to *Nabis ferus* (L.), *Orius* sp. and *Praon palitans* Mues., a parasite of *Therioaphis maculata* (Buckt.), and also to the larvae of *Hippodamia convergens* (Guér.), *H. parenthesis* (Say) and *H. quinquesignata punctulata* Lec., but only moderately so to *Hippodamia* adults, at 11.4 oz. per acre, and only slightly or moderately toxic to *Hippodamia* adults and larvae, *Chrysopa* spp. and *Geocoris* spp. at 3.6–9.5 oz. per acre. Parathion, used as a standard for comparison, was very toxic to the entomophagous species at 3.6–8 oz. per acre, a mixture of 1.3 lb. DDT and 2.6 lb. toxaphene, which is used to control many pests of field crops in California, was very harmful to *H. convergens*, *Geocoris*, *Orius*, *Chrysopa*, *N. ferus*, *Sinea diadema* (F.) and Syrphids, and DDT alone was almost as toxic, whereas toxaphene alone at 2.7 lb. per acre was less toxic

than DDT and much less so than the mixture. Sevin caused marked reductions in *H. convergens*, adults and nymphs of *N. ferus* and adults of *Collops vittatus* (Say) at 19 oz. per acre, and 2.4 oz. heptachlor was moderately toxic to adults of *Geocoris* and *C. vittatus*, but had practically no effect on *H. convergens* or adult and immature stages of *Orius*, *Chrysopa* and *N. ferus*.

REYNOLDS (H. T.), STERN (V. M.), FUKUTO (T. R.) & PETERSON jr. (G. D.). **Potential use of Dylox and other insecticides in a control program for field crop pests in California.**—*J. econ. Ent.* 53 no. 1 pp. 72-78, 5 refs. Menasha, Wis., 1960.

The following is based largely on the authors' abstract. In sprays applied against insects damaging field crops in California, trichlorphon (Dylox) was effective against *Colias eurytheme* Boisds., *Loxostege* spp., *Spodoptera* (*Laphygma*) *exigua* (Hb.) and *Peridroma saucia* (Hb.) (*margaritosa* (Haw.)) on lucerne grown for hay, and gave high mortality of *Lygus* spp., *Chlorochroa sayi* (Stål), and *Euschistus* sp. on seed lucerne, at doses of 1 lb. per acre or less. On cotton, it was effective against *Bucculatrix thurberiella* Busck and *Estigmene acraea* (Dru.) and promising against *Empoasca solana* DeLong and *Platynota stultana* Wlsm. at similar rates, but gave poor results against *Trichoplusia ni* (Hb.) and *Heliothis zea* (Boddie). In general, toxicity was lost in a few days.

The residues on lucerne hay were below 1 part per million four days after the application of trichlorphon at 1 lb. per acre, and only traces were found after ten days.

Trichlorphon was no more effective than several standard insecticides with which it was compared, but it was less toxic to most entomophagous arthropods than many chemicals now used [*cf.* preceding abstract] and relatively non-toxic to honey bees and is therefore considered potentially valuable for use on many field crops.

WENE (G. P.), TUTTLE (D. M.) & SHEETS (L. W.). **Salt-marsh caterpillar control on cotton in Arizona.**—*J. econ. Ent.* 53 no. 1 pp. 78-80, 2 refs. Menasha, Wis., 1960.

Dusts and emulsion sprays containing mixtures of DDT and toxaphene gave good control of *Estigmene acraea* (Dru.) on cotton in Arizona in 1955 and were slightly better than most parathion formulations and much better than sodium-fluosilicate or malathion dusts and endrin, Chlorthion or malathion sprays; but they were less effective than other materials, even at higher dosages, in 1958, and this apparently indicated the development of resistance by the insect [*cf.* *R.A.E.*, A 46 221]. Mixtures of methyl-parathion and toxaphene gave satisfactory control and were better than dieldrin, alone or with toxaphene, in emulsion sprays in 1955, and Dilan [a 1:2 mixture of Prolan and Bulan], trichlorphon (Dylox) and parathion in emulsion sprays, Sevin in sprays or dusts and a mixture of endrin and methyl-parathion in a dust still gave good control in 1958.

WATSON (D. L.) & NAEGELE (J. A.). **The influence of selection pressure on the development of resistance in populations of *Tetranychus telarius* (L.).**—*J. econ. Ent.* 53 no. 1 pp. 80-84, 2 graphs, 6 refs. Menasha, Wis., 1960.

Strains of *Tetranychus telarius* (L.) were developed from a wild population very susceptible to parathion, collected in New York in June 1954. They

were reared through 45 generations at a constant temperature of 90°F.; one strain received no chemical treatment, and the others were treated with a parathion aerosol in every third generation, at dosages giving high and low degrees of mortality, to provide two levels of selection pressure. Resistance developed more rapidly under the high than under the low selection pressure, but the final level of resistance was the same for both. Low selection pressure appeared to produce greater final homogeneity, either owing to chance variability or to population characteristics other than resistance level and rate of development of resistance. High levels of resistance were shown after single severe treatments.

SHIRCK (F. H.). **Response of different strains of the green peach aphid to malathion.**—*J. econ. Ent.* **53** no. 1 pp. 84–88, 3 figs., 5 refs. Menasha, Wis., 1960.

The following is virtually the author's abstract. Several strains of *Myzus persicae* (Sulz.), reproducing parthenogenetically, showed differences in the amounts of malathion required to kill them. Aphids from Nebraska, Illinois and Maryland were initially much less tolerant of malathion sprays than those from California and Washington. Aphids bred from those surviving treatment showed some increase in tolerance over the original strains, but continued selection did not give further increases. Aphids with wing pads withstood malathion applications better than those without.

SIMPSON (R. G.) & BURKHARDT (C. C.). **Biology and evaluation of certain predators of *Therioaphis maculata* (Buckton).**—*J. econ. Ent.* **53** no. 1 pp. 89–94, 2 figs., 9 refs. Menasha, Wis., 1960.

The effectiveness of common native predators of *Therioaphis maculata* (Buckt.) was investigated in Kansas in 1957–58. The life-histories of six species of Coccinellids, two Chrysopids and *Allograpta obliqua* (Say), *Nabis ferus* (L.) and *Orius insidiosus* (Say) and the daily feeding rates of immature and adult stages of most of them, on aphids ranging in size from the first instar to the adult, were determined in the insectary; their relative value in lucerne fields was calculated by estimating populations at intervals during the season and multiplying average daily consumption by average population.

Hippodamia convergens (Guér.) proved to be much the most effective predator, followed in order by *Chrysopa oculata* Say and *C. plorabunda* Fitch, *O. insidiosus*, *N. ferus* and *Ceratomegilla* (*Colcomegilla*) *maculata lengi* (Timb.). The other Coccinellids, *Cycloneda munda* (Say), *H. glacialis glacialis* (F.), *H. parenthesis* (Say) and *Olla abdominalis* (Say), and *A. obliqua* had little effect because populations were extremely low. The average daily consumption of aphids by Coccinellid adults fell from 30.4–122.1 per day at 75°F to one or less per day at 45°F.

TSAO (C. H.) & BOTTGER (G. T.). **Laboratory studies on the effectiveness of Chipman R-6199 against some cotton pests.**—*J. econ. Ent.* **53** no. 1 pp. 103–106, 6 refs. Menasha, Wis., 1960.

In laboratory tests in Texas in 1957, cotton plants growing in cans were sprayed with aqueous solutions of amiton oxalate (Chipman R-6199), infested with insects or mites, either immediately or after various intervals, and left for 48 hours, after which mortality counts were made. The test compound proved about as effective as endrin against larvae of *Estigmene acrea* (Dru.), *Trichoplusia ni* (Hb.), and *Alabama argillacea* (Hb.) at doses

varying from 2 to 8 mg. per plant. At 5 mg., it gave high kills of adults of *Anthonomus grandis* Boh. and *Pectinophora gossypiella* (Saund.) confined on the plants within an hour, but showed little toxicity after 2-6 days, whereas it gave complete mortality of *Aphis gossypii* Glov. for 25 days and of *Tetranychus telarius* (L.) and nymphs of *Hercothrips phaseoli* (Hood) for at least 48 days. In fresh deposits, amiton oxalate was more toxic than DDT to adults of *P. gossypiella*, and a 1:3 mixture of the two showed slight additive action. Residues of amiton oxalate decreased rapidly in the first two days on leaf surfaces, but increased gradually in the leaves, and detached sprayed leaves were found to absorb the chemical during storage. Translocation to new terminal leaves was slow.

BRASS (C. L.) & WARE (G. W.). **BHC translocation from treated soil and the effect on growth of red clover.**—*J. econ. Ent.* 53 no. 1 pp. 110-113, 4 figs., 9 refs. Menasha, Wis., 1960.

The effect of soil type and concentration of insecticide in the soil on the quantity of BHC taken up by forage plants was investigated in the greenhouse in Ohio, and the following is based on the authors' abstract of this account of the work. Red clover [*Trifolium pratense*] was grown in pots of Brookston clay loam and Crosby silt loam that had been treated with 0.1, 1, 10 or 100 parts BHC (40 per cent. γ isomer) per million just before sowing, and the plants were cut and dried when five months old; chemical analysis showed the presence of 0.08, 0.16, 0.91 and 13.84 p.p.m. and 0.1, 0.24, 2.07 and 14.53 p.p.m. BHC, respectively, in the hay. Stunting, malformation and mortality of young plants were proportional to the dosage of BHC, but twice as much was necessary in the clay loam as in the silt loam to produce the same effect on growth. Doses of 200 p.p.m. in the former and 100 p.p.m. in the latter did not affect germination, and plants that survived for nine weeks completely recovered from visible early phytotoxic effects and equalled untreated plants in size and appearance after 16 weeks.

MANGLITZ (G. R.) & KREITLOW (K. W.). **Vectors of alfalfa and bean yellow mosaic viruses in ladino white clover.**—*J. econ. Ent.* 53 no. 1 pp. 113-115, 9 refs. Menasha, Wis., 1960.

The following is substantially the authors' abstract of this account of work carried out in the insectary in Maryland in 1956-58. *Therioaphis trifolii* (Monell), *Anuraphis bakeri* (Cowen) and *Macrosiphum pisum* (Harris) transmitted the virus of lucerne mosaic from infected to healthy plants of ladino white clover, *Trifolium repens*, but only the last two transmitted bean yellow mosaic. When fed on plants infected with both viruses, these two transmitted each separately and indiscriminately. Neither virus was transmitted by *Myzus persicae* (Sulz.), *Rhopalosiphum fitchii* (Sand.), *Empoasca fabae* (Harris), *Aceratagallia sanguinolenta* (Prov.), *Tetranychus atlanticus* (McG.) or a slug.

HENDERSON (C. F.). **A sampling technique for estimating populations of small arthropods in soil and vegetation.**—*J. econ. Ent.* 53 no. 1 pp. 115-121, 8 figs., 1 ref. Menasha, Wis., 1960.

The following is the author's abstract. Apparatus and techniques were devised for estimating populations of arthropods in samples of soil and vegetation. The specimens are extracted from the media by agitating in water, and aliquots are withdrawn during agitation. For the recovery of

soil-inhabiting species, the aliquots are allowed to settle and the clear liquid is run through a series of sieves attached to a vacuum pump. The specimens are concentrated in nylon sieves and counts are made on plastic counting disks. For insects on vegetation, aliquots taken in the same manner are run through Büchner funnels equipped with nylon screens, and the counts are made directly on the screens. Counts made with these techniques indicated recoveries having a mean standard error of about 10 per cent. It is believed that this method may be adapted to almost any small arthropod where the specimens must be extracted from media such as soil and vegetation, and where the numbers are so great that aliquots must be taken to expedite counting.

METCALF (R. L.) & FUKUTO (T. R.). **O-Ethyl S-2-(ethylthio)-ethyl alkylphosphonothioates as systemic insecticides.**—*J. econ. Ent.* **53** no. 1 pp. 127–130, 1 fig., 13 refs. Menasha, Wis., 1960.

In further tests of alkyl phosphonates and phosphonothioates as insecticides [*cf. R.A.E.*, A **49** 68–69], some O-ethyl S-2-(ethylthio)ethyl alkylphosphonothioates and closely related compounds were tested topically against *Musca domestica* L. and systemically against insects and mites on cotton leaves up to 60 days after treatment of the seeds or the stems of the young plants.

The contact toxicity of the O-ethyl S-2-(ethylthio)ethyl alkylphosphonothioates to *M. domestica* was found to decrease as the alkyl chain increased from methyl to iso-pentyl, varying with the polar substituent constant, as had occurred in the ethyl p-nitrophenyl alkylphosphonates [*cf. 49* 68]; the LD₅₀'s of the ethylthioethyl compounds were consistently the higher, and the difference between the two series in inhibition of fly-brain cholinesterase was somewhat greater than the difference in toxicity, though of the same general magnitude, suggesting that there is some metabolic enhancement of the toxicity of the ethylthioethyl compounds in the insect and that toxicity and cholinesterase inhibition are closely related. The substitution of double-bonded sulphur for double-bonded oxygen in O-ethyl S-2-(ethylthio)ethyl ethylphosphonothioate to form the dithioate had practically no effect on toxicity, owing to the *in vivo* oxidation of the sulphur, though the reduction in cholinesterase inhibition was considerable. Toxicity was much lower in O-ethyl O-2-(ethylthio)ethyl ethylphosphonothioate and ethylphosphonate than in any of the S-2-(ethylthio)ethyl compounds, and their anticholinesterase activity was very low.

Large numbers of observations indicated that, in general, the systemic activity of the compounds was closely related to their contact toxicity to *M. domestica*. O-ethyl S-2-(ethylthio)ethyl ethylphosphonothioate was markedly superior to O-ethyl O-2-(ethylthio)ethyl ethylphosphonothioate, as in the corresponding demeton isomers, and O-ethyl S-2-(ethylthio)ethyl ethylphosphonodithioate, like Di-Syston (O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate), was especially effective as a seed treatment; O-ethyl S-2-(ethylthio)ethyl ethylphosphonothioate, the corresponding methyl- and propylphosphonothioates, O-ethyl S-2-(ethylthio)ethyl ethylphosphonodithioate, O-isopropyl S-2-(ethylthio)ethyl ethylphosphonothioate, S-isopropyl S-2-(ethylthio)ethyl ethylphosphonodithioate and O-ethyl S-2-(ethylsulphinyl)ethyl propylphosphonothioate were effective against the larvae of *Bucculatrix thurberiella* Busck as well as against the adult females of *Tetranychus telarius* (L.) and *Heliothrips haemorrhoidalis* (Beh.). Tests of the anticholinesterase activity of the toxicants in cotton-leaf tissue showed that the methyl- and propylphosphonothioates were absorbed and translocated at least as rapidly as demeton-S, and investigations with red spider

mites showed that, although ethyl p-nitrophenyl propylphosphonate was five times as toxic as O-ethyl S-2-(ethylthio)ethyl propylphosphonothioate by topical application to *M. domestica*, it had relatively little systemic effect, as compared with complete mortality for the latter 1-23 days after application.

RATCLIFFE (R. H.), BISSELL (T. L.) & BICKLEY (W. E.). **Observations on soybean insects in Maryland.**—*J. econ. Ent.* **53** no. 1 pp. 131-133, 14 refs. Menasha, Wis., 1960.

Notes are given on the insects and mites observed attacking soy bean in Maryland in 1957, when damage was severe, and 1958, when it was light. In the latter year, an application of 0.66 lb. malathion in 25 U.S. gal. emulsion spray per acre on 16th August caused a noticeable increase in yield, based on the weight of pods and beans, probably mainly owing to reduction of *Epilachna varivestis* Muls. in August; other pests were probably controlled, but populations were too low for differences to be measured. A DDT spray applied on 20th September gave little or no increase in yield, and seed treatment with phorate combined with thiram (Arasan), in emulsion or on activated carbon, reduced the yield in all but one instance, owing to decrease in germination.

DETHIER (V. G.), BROWNE (L. B.) & SMITH (C. N.). **The designation of chemicals in terms of the responses they elicit from insects.**—*J. econ. Ent.* **53** no. 1 pp. 134-136, 13 refs. Menasha, Wis., 1960.

The authors point out that the terms attractant and repellent, which are commonly and loosely used to describe chemical compounds in terms of their effect on the behaviour of insects, should properly be restricted to materials that cause insects to make oriented movements towards or away from them, and propose others to denote other types of reaction. These are arrestant, to describe a compound that causes insects to aggregate in contact with it; locomotor stimulant, for one that increases their rate of dispersal; feeding, mating or ovipositional stimulant, for one that elicits these actions; and deterrent for one that inhibits feeding or oviposition.

LICHTENSTEIN (E. P.), DE PEW (L. J.), ESHBAUGH (E. L.) & SLEESMAN (J. P.). **Persistence of DDT, aldrin, and lindane in some midwestern soils.**—*J. econ. Ent.* **53** no. 1 pp. 136-142, 2 figs., 15 refs. Menasha, Wis., 1960.

The following is based largely on the authors' abstract. In the tests described, DDT at 10-1,000 lb., aldrin at 2-200 lb., and lindane [almost pure γ BHC] at 1-1,000 lb. per acre were applied in emulsions to fields of silt loam in Kansas, muck and sandy loam in Ohio and all three soils in Wisconsin in May-June 1954, and immediately mixed in to a depth of six inches. Colorimetric analysis and bioassay with *Drosophila melanogaster* Mg. immediately, after six months and then annually for four years showed that DDT was the most and γ BHC the least persistent. Soil treated with 2 lb. aldrin contained no aldrin but 0.03-0.19 parts dieldrin per million [cf. *R.A.E.*, **A 47** 56] in the autumn of 1958, and soil treated with 1 lb. γ BHC contained none after 4½ years. Persistence was affected most by the amount of organic matter in the soil and the climatic conditions, and all insecticides dispersed most rapidly in the Kansas area.

HOWE (W. L.) & PESHO (G. R.). **Influence of plant age on the survival of alfalfa varieties differing in resistance to the spotted alfalfa aphid.**—*J. econ. Ent.* **53** no. 1 pp. 142–144, 7 refs. Menasha, Wis., 1960.

In investigations in California in 1957 on the effect of plant age on the damage caused to lucerne by *Therioaphis maculata* (Buckt.), severe infestation was allowed to develop on plants of two resistant and two susceptible varieties 3–41 days after the seedlings appeared, and observations of plant mortality were made after periods of 9–21 days. The following is based on the authors' abstract of the results. Increased plant age significantly decreased the mortality of the two resistant varieties, Lahontan and Moapa, but had no effect on that of Caliverde except after the shortest exposure, whereas the mature plants of African, a more tolerant but susceptible variety, survived slightly longer than the younger seedlings. About half the seedlings of Lahontan and Moapa infested in the cotyledon stage and about a quarter of those infested when they had 2–3 trifoliate leaves were killed after exposure for 21 days to the increasing aphid population, whereas not more than 3 per cent. of the mature plants were killed. At all ages, African was more tolerant than Caliverde, which was killed in 21 days. The higher survival of Lahontan and Moapa, despite high aphid populations, indicated that tolerance as well as antibiosis [*cf. R.A.E.*, A **45** 352] contributed to their resistance.

CLEVELAND (M. L.). **Soil injection as a means of applying systemic acaricides to fruit trees.**—*J. econ. Ent.* **53** no. 1 pp. 144–146, 2 figs. Menasha, Wis., 1960.

In small-scale tests in Indiana in 1957, the injection of 6 U.S. gal. water containing 9 oz. demeton, phorate or amiton oxalate (Chipman R-6199) to a depth of 2 ft. into the soil under a mature apple tree controlled *Tetranychus telarius* (L.) and *Panonychus ulmi* (Koch) on the tree for some weeks, and more extensive tests in 1958 showed that treatment with 12 oz. phorate in 90 per cent. emulsion concentrate per 100 U.S. gal. at 36 U.S. gal. per tree on 23rd April in one orchard and at 120 U.S. gal. per tree on 12th June in another caused very effective reductions in populations of *P. ulmi* for at least two months, whereas treatment with 15–16 oz. water-soluble amiton oxalate per 100 U.S. gal. caused only small reductions in the first orchard and practically none in the second. Two devices for making such injections are described.

PESHO (G. R.), LIEBERMAN (F. V.) & LEHMAN (W. F.). **A biotype of the spotted alfalfa aphid on alfalfa.**—*J. econ. Ent.* **53** no. 1 pp. 146–150, 6 refs. Menasha, Wis., 1960.

The appearance near El Centro, California, in February 1958 of symptoms of susceptibility in a lucerne clone that had been unaffected by *Therioaphis maculata* (Buckt.) in the three preceding years indicated the development of a biotype of the aphid that could reproduce on this and perhaps other resistant clones; the ability of *T. maculata* to develop biotypes had already been noted [*R.A.E.*, A **47** 325]. Tests showed that these aphids could survive and reproduce on three of the nine parent clones of the aphid-resistant non-dormant variety Moapa, but not on five others or on five parent clones of the resistant variety Lahontan. In a cage test of Moapa as a variety grown from breeder seed, they produced much higher populations than normal aphids, but did not cause higher plant mortality.

The consistent results obtained in two localities and under various weather conditions supported the view that a new biotype had appeared, but it was thought likely to cause little damage to Moapa unless it became dominant in the population of the area. It is doubtful whether infestations as large as those observed in the cage test would develop in the field, and if they did, they would be far below those that develop on susceptible varieties of lucerne.

SCHLINGER (E. I.). **Diapause and secondary parasites nullify the effectiveness of rose-aphid parasites in Riverside, California, 1957-1958.**—*J. econ. Ent.* **53** no. 1 pp. 151-154, 1 graph, 6 refs. Menasha, Wis., 1960.

Investigations on the Braconid parasites of *Macrosiphum rosae* (L.) were made at Riverside, California, in 1957-58 to find the reasons for their ineffectiveness in control. Parasitised aphids were collected from unsprayed rose plants, and the primary parasites that emerged from them were *Aphidius nigripes* Ashm., *A. alius* Mues., *Praon occidentalis* Baker, *P. unicus* C. F. Smith and *A. confusus* Ashm. Observations on all but the last, which was very scarce, showed that they all parasitised other hosts and possibly preferred them, and that some of their larvae entered diapause in each generation, the proportion increasing until all of the fourth or fifth did so. They remained in diapause in the cocoons throughout the summer and winter and transformed after about eight months, and large numbers of these cocoons and small numbers of those of parasites not in diapause were present throughout the season and were readily attacked by the secondary parasites, *Asaphes californicus* Gir., *Pachyneuron siphonophorae* (Ashm.), *Aphidencyrthus aphidivorus* (Mayr) and *Charips* spp. These bred in large numbers in *Aphidius testaceipes* (Cress.), which was almost always present, and sometimes destroyed 70 per cent. of the parasites of *M. rosae*. Physical factors, aphid and plant physiology and predators appeared to be responsible for the ultimate decline in the aphid population in late spring.

EVERLY (R. T.) & PICKETT (R. C.). **The effect of phorate applied to seed on the growth, development and insects attacking grain sorghum.**—*J. econ. Ent.* **53** no. 1 pp. 154-160, 3 graphs, 13 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract of this account of tests carried out in Indiana, in which sorghum seed was treated with 0.5, 1, 2 or 4 lb. phorate per 100 lb., with an adhesive and with or without 10.67 oz. thiram (Arasan), or (without phorate) with thiram or the adhesive or both. In field tests in 1958, phorate at the two higher rates seriously reduced the stand and delayed plant development as measured by pollen shedding, whereas the lower rates did not cause significant reductions in stand and advanced pollen shedding. The plots receiving phorate gave significantly lower yields of seed than untreated ones, and highly significant differences in yield were associated with differences in stand.

In greenhouse tests in 1958-59, germination was reduced and prolonged for about two days by the two higher dosages, percentage germination in the greenhouse being very significantly correlated with the stand in the field. Treated seed that had been stored for ten months showed a great reduction in germination. Thiram reduced the phytotoxic effect of phorate and the deleterious effect on germination shown by the adhesive. Phorate at the two higher rates controlled *Aphis* (*Rhopalosiphum*) *maidis* Fitch

during the earlier period of growth, in greenhouse tests, but it gave no reduction in the field, where large populations of the aphid develop in the bagged heads and are a problem to breeders of sorghum.

HILLS (O. A.), BENNETT (C. W.), JEWELL (H. K.), COUDRIET (D. L.) & BRUBAKER (R. W.). **Effect of virus yellows on yield and quality of sugar beet seed.**—*J. econ. Ent.* 53 no. 1 pp. 162-164, 1 fig., 3 refs. Menasha, Wis., 1960.

An extensive area is devoted to the production of sugar-beet seed in the Salt River valley of Arizona, where the plants are grown from late August to June. The yield and viability of the seed have been low since 1955, when the yellows virus, which is transmitted by *Myzus persicae* (Sulz.), first occurred on the crop, and tests of the effects of this virus and that of curly top, which is transmitted by *Circulifer tenellus* (Baker), on seed production were made on the crops harvested in 1956-58. The following is based on the authors' summary of the results. The yield was reduced in plants infected by either virus alone or by both, and germination of seeds from infected plants was reduced in one of four tests with virus yellows and in two of three with the combined viruses, but not in two with curly top alone. In field tests with *M. persicae*, in which aphids infected with the yellows virus were confined on the plants for 24-48 hours and then destroyed, reductions in yield occurred in all treated plots, early infections causing greater reductions than later ones. Reductions in germination resulted from transmission by *M. persicae* in late February, when spring growth was well begun, or in late April, when the plants were in flower, but not in autumn or in late March or early April.

ELMER (H. S.). **Evaluation of insecticides for control of the Fuller rose beetle on *Citrus* in California.**—*J. econ. Ent.* 53 no. 1 pp. 164-165, 1 ref. Menasha, Wis., 1960.

Pantomorus cervinus (Boh.) (*godmani* (Crotch)) occurs in all the commercial *Citrus*-growing areas of California and occasionally becomes of economic importance on young trees. The weevil has one generation a year, the adults emerging in July-November, feeding on the leaves and ovipositing on the plants, and the larvae entering the ground and feeding on the roots before pupating in the next summer. In an orange grove that was being severely defoliated by the adults, sprays of chlordane, aldrin, endrin, dieldrin, toxaphene or cryolite applied to the trees from ground level to a height of about 6 ft. on 15th October 1954 eliminated the beetles for the rest of the year, but their reappearance in 1955 indicated that most of the larvae had hatched and entered the ground before treatment.

In greenhouse tests, *Citrus* seedlings were thoroughly sprayed with 1, 2 or 4 oz. toxicant per 100 U.S. gal., allowed to dry and caged with groups of five adults each, which were replaced as they died until no more were killed by the residues. Weekly observations showed that dieldrin and azinphos-methyl (Guthion) were the most effective of the materials tested, giving protection for 7-8 weeks at 1 and 2 oz., respectively, followed by malathion and chlordane. DDT, endrin, Chlorthion and cryolite at 4 oz. were effective for 4-5 weeks, but other compounds had little or no value.

It is concluded that to control *P. cervinus* for more than one year, it would be necessary to time applications so as to kill the adults before they oviposit, to spray repeatedly, or to use an insecticide with a very long residual effect.

TURNIPSEED (G. F.). **Biology and control of the apple seed Chalcid in North Carolina.**—*J. econ. Ent.* **53** no. 1 p. 166, 3 refs. Menasha, Wis., 1960.

Investigations were made in 1955–58 on the life-history of *Syntomaspis varians* (Wlk.) (*Torymus druparum* Boh.), attacking apples in North Carolina [cf. *R.A.E.*, A **44** 391], in which infested seeds taken either immediately or in the following spring from apples collected in the autumn of 1955 were examined at intervals. It was found that the larvae overwintered in the seeds and pupated in late April. Adults emerged during 10–14 days in early May, when immature apples were 0.5–1 in. in diameter, and usually began to oviposit within two days. Some larvae spent two winters in the seeds, but none survived for three. The proportion of larvae spending a second winter in the seeds may depend on the rate of decay of the apple; 96.8 and 80 per cent. of the adults emerged after one winter and 3.2 and 20 per cent. after two in the seeds collected from the fruit in the autumn and in the next spring, respectively.

In 1957, a spray of 2 lb. 50 per cent. wettable DDT or Sevin or 4 lb. 25 per cent. wettable malathion per 100 U.S. gal. water on 21st May, when the apples were 0.5 in. in diameter, gave effective control, which was not improved by a second application on 4th June, whereas demeton, phorate (Thimet) and Delnav (2,3-p-dioxane S,S-bis(O,O-diethyl phosphorodithioate)) were relatively ineffective.

MCALLAN (J. W.) & BROWN (A. W. A.). **The effect of insecticides on transamination in the American cockroach.**—*J. econ. Ent.* **53** no. 1 pp. 166–167, 4 refs. Menasha, Wis., 1960.

In view of the possible importance of insecticides in inhibiting the enzymes that catalyse amino-acid metabolism in insects, the effect of sodium cyanide, sodium orthoarsenate, DDT, malathion, toxaphene and endrin on the glutamate-aspartate transamination reaction was studied in *Periplaneta americana* (L.). In tests *in vitro*, all but sodium orthoarsenate inhibited the enzyme, but only sodium cyanide did so in tests *in vivo*. It is suggested that the inhibition by the organic insecticides *in vitro* was an artifact, due to adsorption of protein enzyme by the resulting suspension of insecticide [cf. *R.A.E.*, A **45** 435].

SMYTH jr. (T.). **Action of DDT at an insect synapse.**—*J. econ. Ent.* **53** no. 1 pp. 170–171, 1 fig., 11 refs. Menasha, Wis., 1960.

In the experiments described, the application of DDT suspension to the partially desheathed last abdominal ganglion of *Periplaneta americana* (L.) increased the response of the post-synaptic fibre to electrical stimulation of a cercal nerve. This did not occur when the sheath was intact, and it is concluded that the action of DDT must be central, synaptic, rather than on the cercus or cercal nerve.

PIMENTEL (D.) & CRANSTON (F.). **The house cricket, *Acheta domesticus*, and the house fly, *Musca domestica*, as a model predator-prey system.**—*J. econ. Ent.* **53** no. 1 pp. 171–172, 2 refs. Menasha, Wis., 1960.

As the older nymphs and adults of *Acheta domesticus* (L.) consume the pupae of *Musca domestica* L., they can be used for studying the mechanisms

that underlie the dynamic relations of predators and prey. The authors give details of methods of rearing and of adjusting populations to show variable responses and explain the advantages, including relatively short life-cycles and tolerance of both insects to a wide variety of conditions, which allows them to be reared together in many different environmental situations. The crickets find the pupae by touch, odour being apparently of little importance.

BLOCK (B. C.). **Laboratory method for screening compounds as attractants to gypsy moth males.**—*J. econ. Ent.* **53** no. 1 pp. 172–173, 1 ref. Menasha, Wis., 1960.

The author describes a laboratory method of testing the attractiveness of natural and synthetic substances for males of *Lymantria* (*Porthetria*) *dispar* (L.), which are tethered by the wings and hung from racks. Preliminary tests indicated general agreement between laboratory and field results, though the former were less consistent, and it is considered that the laboratory technique should permit easier and cheaper tests over a longer period than is possible in the field.

MEDLER (J. T.) & SMITH (P. W.). **Membracidae attracted to black light.**—*J. econ. Ent.* **53** no. 1 pp. 173–174, 5 refs. Menasha, Wis., 1960.

A large flight of Membracids occurred in a residential area among oak trees at Middleton, Wisconsin, after dark on 6th June 1959. An ultra-violet light-trap with two 15-watt lamps and another with one 6-watt lamp caught very large numbers, far exceeding those of other insects, between 8 p.m. and 6.30 a.m. each night from 7th to 10th June, fewer on 11th June, when the minimum temperature was 61°F., and insignificant numbers on 12th June, when it was 53°F. They consisted almost entirely of males and belonged to 17 species in three genera.

HARRISON (F. P.). **Experiments for the control of sap beetles in sweet corn grown for processing.**—*J. econ. Ent.* **53** no. 1 pp. 174–175, 4 refs. Menasha, Wis., 1960.

In view of the increasing importance of sap beetles, mainly *Carpophilus lugubris* Murr., on sweet maize in Maryland [*cf. R.A.E.*, A **48** 462], the effect of adding organic phosphates to the emulsion sprays of DDT and oil applied for the control of *Heliothis zea* (Boddie) was tested on small plots in 1958. In applications of 1 lb. DDT and 7 U.S. quart mineral oil in 25 U.S. gal. water per acre, made with a high-clearance sprayer on 28th July, when 10–20 per cent. of the plants were in silk, and on 3rd and 9th August, 1 U.S. quart 25 per cent. parathion or 57 per cent. malathion emulsion concentrate reduced the average percentage of damaged ears significantly, mainly owing to reduction of *Carpophilus*. Trithion, diazinon and, applied on 3rd August only, dimethoate, had no significant effect, possibly owing to reinfestation of the plots, which were small. In 1959, in tests on a field scale, 1 U.S. quart 57 per cent. malathion emulsion concentrate and 2 lb. wettable trichlorphon (Dylox) added to the DDT spray on 9th July reduced the percentage of ears injured by sap-beetle larvae at harvest from 73.4 to 8.6 and 13.5, respectively, though they did not appear to reduce the numbers of adults in the fields.

THATCHER (R. C.). **Toxicity of BHC to loblolly pine seedlings.**—*J. econ. Ent.* **53** no. 1 pp. 175–176, 1 fig., 3 refs. Menasha, Wis., 1960.

Details are given of the adverse effect on seedlings of loblolly pine (*Pinus taeda*) of dipping them in BHC suspension or emulsion, which has been recommended for the control of *Pachylobius plicivorus* (Germ.) in Texas [cf. *R.A.E.*, A **48** 131].

STONE (M. W.) & ANDERSON (L. D.). **Experiments on control of the sugar-beet wireworm in southern California bean fields.**—*J. econ. Ent.* **53** no. 1 pp. 176–177, 2 refs. Menasha, Wis., 1960.

In two fields in southern California, insecticides were applied to the soil surface in 35 U.S. gal. emulsion spray per acre on 31st March and 16th June 1952, respectively, and immediately disked in to a depth of 7–8 in. for the control of *Limonijs californicus* (Mannh.). Counts of the wireworms made in bait rows of beans or maize each spring in 1952–57 showed that aldrin and chlordane gave inconsistent results in the two fields [cf. *R.A.E.*, A **46** 187], that 1.5 lb. toxaphene was promising and that 10 lb. DDT was unexpectedly rapid in effect. The DDT treatment and 2 lb. dieldrin or endrin gave the most consistent results, with excellent control for six years.

DOUCETTE (C. F.). **The shallot aphid in the Pacific Northwest.**—*J. econ. Ent.* **53** no. 1 pp. 177–178, 12 refs. Menasha, Wis., 1960.

Myzus ascalonicus Doncaster was found on Easter lilies [*Lilium longiflorum*] in a greenhouse in Washington State in February 1955 and was collected from the same food-plant in southern Oregon and northern California several times in subsequent seasons. Its occurrence was irregular, owing to the control measures employed, but it could usually be found on plants growing from discarded bulbs, which are probably an important means of maintaining the population in the lily-producing areas, particularly in late autumn and early winter.

The aphid is known to occur in Michigan [*R.A.E.*, A **45** 226] and Canada [**44** 228], and it was found on strawberry in British Columbia in 1955. In 1958, it occurred on strawberry in western Washington and the Willamette Valley of Oregon, and its behaviour resembled that recorded in England [**40** 276], the aphids leaving the plants in May or early June and returning in October. Severe injury was associated with mild weather in winter and early spring.

The summer food-plants of the aphid in Europe are uncertain. Its occurrence on carrot in British Columbia in large numbers in autumn [**44** 228] indicates that this may have been the summer food-plant there, but it was collected several times on lilies in summer, on pansies in Washington in July and in numbers on chickweed [*Stellaria media*] in lily fields in California in September. The aphid is a vector of several plant viruses [cf. **35** 206], but no case of transmission in North America is known.

POINAR jr. (G. O.) & GYRISCO (G. G.). **A nematode parasite of the alfalfa weevil (*Hypera postica* (Gyll.)).**—*J. econ. Ent.* **53** no. 1 pp. 178–179, 1 fig. Menasha, Wis., 1960.

Larvae of *Hypera variabilis* (Hbst.) (*postica* (Gyllh.)) parasitised by nematodes were collected from a lucerne field in Dutchess County, New

York, in June 1959 and also found in other lucerne fields in that county and in Ulster and Orange counties; only fourth-instar individuals were attacked, and there were up to three nematodes, identified as Mermithids, per larva.

SCHREAD (J. C.). **Pod gall of honey locust.**—*Circ. Conn. agric. Exp. Sta.* no. 206, 4 pp., 1 fig., 4 refs. New Haven, Conn., 1959.

Injury to honey locust (*Gleditsia triacanthos*) by *Dasyneura gleditschiae* (O.-S.) is increasing in Connecticut with the increasing cultivation of thornless varieties of the tree. The larvae feed on the inner surfaces of the leaflets, causing them to curl over and form galls, in which they feed and pupate, and severely galled leaflets dry and fall prematurely; all the leaflets are attacked in a severe infestation, but regrowth occurs and the trees are rarely killed. The midge seems to pass the winter in the adult stage, and begins to oviposit in April, when the trees start growth. The eggs are inserted singly or in small clusters among the young leaflets and hatch in a day or two. The larvae begin feeding immediately, and galls may be well formed by 21st May. There were 5-7 overlapping generations in the season in southern Connecticut in 1956-58.

In 1956, when sprays were applied to the foliage of infested trees on 21st May, 1 pint 20 per cent. lindane [almost pure γ BHC] per 100 gal. gave 85.7 per cent. kill of the first generation and was better than 1 pint 25 per cent. DDT, 20 per cent. endrin or 57 per cent. malathion. In 1958, treatment with 3 per cent. DDT in emulsion spray on 21st April, before the leaves opened or adults or eggs were present, controlled the first generation, but not the second, and delayed the opening of the buds.

DOANE (C. C.). **The red pine scale.**—*Circ. Conn. agric. Exp. Sta.* no. 207, 7 pp., 3 figs., 3 refs. New Haven, Conn., 1959.

The author describes the spread of *Matsucoccus resinosae* Bean & Godwin on red pine (*Pinus resinosa*) and certain introduced pines [cf. *R.A.E.*, A 46 259] since its discovery in Connecticut in 1946 [cf. 44 273-274] and describes its bionomics and the injury it causes [cf. 44 274]. Eggs are deposited from May until late June and from August until the end of October, and adults and crawlers may be present until the end of November. Control is not economic on trees in plantations, and they should be cut as they become infested and begin to die, preferably during the winter, as the partly-grown overwintering nymphs die when disturbed; if they are cut during the warmer months, the branches should be burnt and the logs stacked and sprayed with DDT or BHC to protect them from bark borers. Sprays may be useful to protect ornamental trees, and the results of earlier investigations [cf. 44 274] indicate that applications of 2 per cent. oil emulsion in early June and early September will probable reduce populations to a level that will not endanger the tree.

MILLER (W. E.). ***Petrova houseri*, a new pitch-nodule moth from eastern North America.**—*Ohio J. Sci.* 59 no. 4 pp. 230-232, 5 figs., 4 refs. Columbus, Ohio, 1959.

Petrova houseri, sp. n., is described from adults reared from larvae found attacking the current shoots of shortleaf pine, *Pinus echinata*, in Ohio, and its relation to other species of the genus is discussed.

- GRIFFITHS (J. T.) & THOMPSON (W. L.). **Insects and mites found on Florida Citrus.**—*Bull. Fla agric. Exp. Sta.* no. 591, 96 pp., 96 figs. (5 col.), 61 refs. Gainesville, Fla., 1957.
- KUITERT (L. C.). **Insect pests of ornamental plants.**—*Op. cit.* no. 595, 51 pp., 34 figs., 6 refs. 1958.

In these two bulletins, which relate to conditions in Florida, information is given on the appearance, bionomics and sometimes control of the pests concerned. The second includes notes on insecticides and apparatus for applying them.

- HILDEBRAND (E. M.). **Two syndromes caused by sweetpotato viruses.**—*Science* 128 no. 3317 pp. 203–204, 1 fig., 10 refs. Lancaster, Pa., 1958.
- HILDEBRAND (E. M.) & SMITH (F. F.). **Aphid transmission of a virus associated with sweetpotato internal cork and masked in feathery-mottle-infected sweetpotatoes.**—*Plant Dis. Repr* 42 no. 10 pp. 1148–1153, 1 fig., 6 refs. Washington, D.C., 1958.

It is stated in the first of these papers that two virus syndromes have been distinguished on sweet potato [*Ipomoea batatas*] in the United States, those of feathery mottle and internal cork. In transmission experiments begun in 1954, *Myzus persicae* (Sulz.) and *Macrosiphum euphorbiae* (Thos.) (*solanifolii* (Ashm.)) transmitted a virus from sweet potato to sweet potato that was distinguished by chlorotic spots on the foliage, which are typical of internal cork. The aphids acquired the virus from plants of the Porto Rico variety showing symptoms of internal cork and plants derived from an introduced Russian sweet potato showing symptoms of feathery mottle, but the latter was not transmitted. There was 100 per cent. transmission of the chlorotic-spot symptoms, based on the 'flush of growth' indexing technique, which requires only two months, but only 20 per cent. transmission of the necrotic root symptom of internal cork after storage of roots for six months. Some transmission of feathery mottle was found to occur in the field, especially in 1957, when conditions favoured late vegetative growth. Both syndromes were found side by side during a survey in Georgia in 1955 and in California and New Jersey in 1957. Two similar diseases also occur in other countries [cf. *R.A.E.*, A 46 497; 47 481].

The transmission experiments are described in more detail in the second paper, in which it is further stated that *Myzus persicae* transmitted the internal cork symptoms from sweet potato and some close relatives of it to Scarlet O'Hara morning glory [*I. bona-nor* × *I. hedracea*], with an incubation period of usually less than a fortnight. When the virus source was plants also infected with feathery mottle, the incubation period was usually 12 days or longer, as compared with about half that period for plants infected with internal cork alone. Such rapid results greatly facilitate transmission studies.

- LANGE (W. H.) & GRIGARICK (A. A.). **Rice water weevil. Beetle pest in rice growing areas of southern States discovered in California.**—*Calif. Agric.* 13 no. 8 pp. 10–11, 5 figs. Berkeley, Cal., 1959.

Young rice plants damaged by *Lissorhoptrus oryzophilus* Kuschel, which was not previously known in California, were found near Biggs, in Butte County, in June 1959, although the weevil had probably been introduced before that year. Adults were active on 1st June, and full-fed larvae were

found on the roots by 1st July; the adults lived for about three weeks in cages. The weevil evidently bred on wild grasses and sedges and fed on these before the rice appeared. Draining the rice-fields is not considered a practical means of control in California, but applications of dieldrin, commonly made against the rice leaf-miner [*Hydrellia griseola* (Fall.)] [cf. *R.A.E.*, A 49 112], should control the adults if made when they are feeding on the leaves.

In a footnote, the editor records that an area of 400 sq. miles in Butte, Glenn and Yuba counties was reported to be infested by *L. oryzaophilus* on 16th July 1959.

BACON (O. G.), MISKUS (R.), MORSE (M. D.) & SAILSBERY (R. L.). **Corn earworm in grain sorghum. Phosdrin and Thiodan show promise as substitutes for DDT in two experiments with aerial applications to infested fields.**—*Calif. Agric.* 13 no. 8 pp. 12–13. Berkeley, Cal., 1959.

Heliothis zea (Boddie) infested 90–99 per cent. of the sorghum heads in some fields in Butte and Glenn Counties, California, in 1957 and 1958; there were usually 1–4 larvae per head, but sometimes 10–16. Treatment of a new hybrid variety by aeroplane on 4th September 1958 with 25 lb. 10 per cent. DDT dust or 2 lb. DDT or 1 lb. mevinphos (Phosdrin) or Thiodan in 10 U.S. gal. emulsion spray per acre caused 98·8, 98·8, 97·1 and 95 per cent. reduction, respectively, in the numbers of larvae, which were mainly in the first three instars, but had little or no effect in reducing the numbers of infested heads, as many had been attacked before treatment. Similar treatments had little effect on a variety with tighter, more compact heads that was infested mainly with older larvae. DDT residues were generally low on the threshed grain 18 days or more after dusting, but were about 2 parts per million 39 days after spraying. As Federal requirements prohibit any residue on the grain, it is suggested that mevinphos or Thiodan should be used and applications made when the larvae are small and have not fed extensively.

GRAHAM (H. M.). **Effects of temperature and humidity on the biology of *Therioaphis maculata* (Buckton).**—*Univ. Calif. Publ. Ent.* 16 no. 2 pp. [3+] 47–80, 10 graphs, 23 refs. Berkeley, Cal., 1959.

The following is virtually the author's summary of this account of investigations in which the effects of temperature and relative humidity on the development, reproduction and adult life-span of *Therioaphis maculata* (Buckt.) were determined over a range of conditions.

The lower threshold temperature for nymphal development was estimated to be approximately 8·5°C. [47·3°F.]. There were indications that the upper limit was influenced somewhat by humidity, with the lower humidities being more favourable. This was found to be 37°C. [98·6°F.] at a relative humidity of 65–70 per cent. The optimum temperature for nymphal development was 30°C. [86°F.], at which the aphids were able to complete their development in 5·5 to 5·6 days at all humidity levels. At 35°C. [95°F.], development was slightly slower, especially under conditions of 90 per cent. relative humidity. There was also a high mortality among the aphids reared at high humidity at 35°C. The second instar seemed to have the shortest duration, and the fourth had the longest.

A short preparturition period was passed by the aphids before deposition of progeny. This was shortest at 20°C. [68°F.] with a mean of 0·4 day,

and longest at 11°C. [51.8°F.], with a mean of 4.56 days. The aphids that completed their development at the high humidity at 35°C. did not deposit any progeny before dying. Those at the intermediate humidity range at this temperature deposited only dead progeny, which were still contained within the embryonic membrane. At low humidity at 35°C., all progeny were deposited alive. At 30°C., live progeny were deposited at all humidity levels.

The duration of reproduction was found to vary inversely with temperature; the low humidity gave a longer reproductive period than the two higher levels at all temperatures. The peak fecundity was reached at 20°C., with low humidity again favouring this factor. The maximum fecundity rate was reached at 25°C. [77°F.] at low and intermediate humidities and at 20°C. at high humidity. Again the low humidity was most favourable.

Adult life-span showed an inverse relation with temperature; lower humidity favoured this factor, especially at the high temperature ranges.

The factors indicating the ability of aphid populations to increase at the various conditions, namely, the innate capacity for increase and the finite rate of increase, demonstrated that the low humidity level at 30°C. was most favourable for increase of aphid populations. This was followed by the 25°C. low humidity conditions. The low humidity was superior to the higher ones at all temperatures tested. There was a lessening of adverse effects of the high humidities as the temperature decreased.

The integration of chemical and biological control of the spotted alfalfa aphid.

STERN (V. M.), SMITH (R. F.), VAN DEN BOSCH (R.) & HAGEN (K. S.). **The integrated control concept.**—*Hilgardia* 29 no. 2 pp. 81–101, 7 graphs. 3½ pp. refs. Berkeley, Cal., 1959.

STERN (V. M.) & VAN DEN BOSCH (R.). **Field experiments on the effects of insecticides.**—*T.c.* pp. 103–130, 1 graph, 8 refs.

SMITH (R. F.) & HAGEN (K. S.). **Impact of commercial insecticide treatments.**—*T.c.* pp. 131–154, 12 graphs, 10 refs.

In these three papers, the authors record investigations in California on the way in which insecticides can be used against pests to supplement the controlling effect of natural enemies, with particular reference to *Therioaphis maculata* (Buckt.) on lucerne in California.

In the first paper, integrated control is defined [*cf. R.A.E.*, A 49 66] and shown to be most successfully applied when sound economic thresholds of injury have been established, rapid sampling methods have been devised and selective insecticides are available.

In the second, field experiments in California in 1956–57 on the effect of sprays of parathion, malathion, Trithion, mevinphos (Phosdrin) and demeton (Systox) on *T. maculata* and its parasites and predators are described [*cf. 48* 179]. All were effective against the aphid. Parathion and malathion were extremely toxic to a wide variety of phytophagous and entomophagous insects and permitted more rapid re-establishment of *T. maculata* than of its natural enemies. Mevinphos was rather less toxic to the natural enemies than parathion, malathion or Trithion, but much more so than demeton, which gave satisfactory aphid control, even when the initial kill was poor, since natural enemies were little affected and continued to attack the surviving aphids, which they eventually controlled completely.

The third paper is essentially a report of the effect of insecticide treatments on insect predators of *T. maculata* in a selected group of commercial fields in which lucerne was grown for hay, from which it is concluded that native predators keep aphid populations below the economic threshold for most

of the growing season in the Central Valley and throughout the year in other regions of California. Selective insecticides should be used if the population approaches the economic level.

It is stated in an introduction to the whole work that integrated control of *T. maculata* has been achieved in California. Economic thresholds have been established, so that insecticides are applied only when damage is imminent. Native predators, introduced parasites [cf. 48 226-228] and entomogenous fungi [cf. 48 215] keep populations below the economic threshold for most of the year; when population counts in a particular field demonstrate that it is threatened, demeton is applied at low dosages, giving adequate control, but not necessarily eradicating the aphid. Most of the predators and parasites survive and attack the remaining aphids.

TZANAKAKIS (M. E.). An ecological study of the Indian-meal moth *Plodia interpunctella* (Hübner) with emphasis on diapause.—*Hilgardia* 29 no. 5 pp. 205-246, 57 refs. Berkeley, Cal., 1959.

The following is based largely on the author's summary. Laboratory tests carried out in 1957-58 in California showed that full-fed larvae of *Plodia interpunctella* (Hb.) may enter a facultative diapause late in the season, provided that temperatures of 25°C. [77°F.] or higher and 20°C. [68°F.] or lower are reached during the egg and late larval stages, respectively; under favourable temperature conditions, continuous darkness, particularly during late larval growth, increased the tendency.

Investigations with two strains of *P. interpunctella* from California showed a marked difference in the tendency to diapause between the strains and a wide variation in the intensity of diapause regardless of the strain. The duration of diapause was reduced as its intensity fell and the temperature rose, and the intensity and, therefore, duration of diapause varied between groups that were reared under different conditions and also between individuals from the same parents, reared under the same conditions.

Low temperatures were not required for the normal termination of diapause, and exposure for 14 weeks to 10 or 20°C. [50 or 68°F.] gave about equal results. Wounding the larvae or forcing them to respin their hibernacula repeatedly had some effect in terminating the diapause, whereas exposure to -5, -18 or 50°C. [25, -0.4 or 122°F.] had little or none. Larvae that were going to enter diapause developed more slowly than those that were not, though some of those that grew most slowly developed without diapause. Acclimatisation at low temperatures increased cold-hardiness, but larvae that were to enter diapause were more cold-resistant than others of the same strain [cf. *R.A.E.*, A 47 451].

STERN (V. M.) & SMITH (R. F.). Factors affecting egg production and oviposition in populations of *Colias philodice eurytheme* Boisduval (Lepidoptera: Pieridae).—*Hilgardia* 29 no. 10 pp. 411-454, 15 figs., 3 pp. refs. Berkeley, Cal., 1960.

The larvae of *Colias eurytheme* Boisd. reach very high numbers on lucerne during the more favourable summer months in California, and investigations were carried out in 1949-52 on the factors affecting egg-production and oviposition and their effects on population trends. The following is based on the authors' summary of the results.

The reproductive system of the female, which is described, does not differ greatly from those of other Lepidoptera with two genital apertures; mating

usually occurs a few hours after emergence and involves the passage of a spermatophore, and there is a short preoviposition period. Laboratory tests showed that the duration of this depends on temperature and available food, both of which largely control oögenesis; some sugar is necessary for the maturation of a large number of eggs. Adult feeding was less important in its effect on oviposition, and temperature was generally more critical than humidity, light intensity or food. The limits of body temperature for oviposition were 21 and 46°C. [69.8 and 114.8°F.], with an optimum of 32°C. [89.6°F.] for a high rate of oviposition. The optimum relative humidity was 26–45 per cent., but any effect of humidity was masked by the effects of extreme temperatures. The optimum temperature and humidity were similar under field conditions. Females laid as many as 1,172 eggs each in the laboratory, and the average was about 715, but these numbers are probably seldom reached in the field. Males usually outnumbered females, probably because the latter develop more slowly in the larval stage and are therefore subjected to adverse conditions, including a polyhedral virus disease, for longer.

ANDERSON (R. F.). **Forest and shade tree entomology.**—9¼ × 6 in., vii + 428 pp., 126 figs., refs. New York, N.Y. & London, J. Wiley & Sons, Inc., 1960. Price £3 8s. or \$8.50.

This book on the insect pests of shade and forest trees and wood products in the United States and Canada is divided into two sections. The first, and shorter, consists of chapters containing general information on insects, their development, classification and ecology, the control of insects, insecticides and techniques for applying them to trees and timber, and the methods used in making forest-insect surveys. The second, and more important, section is devoted to the insects themselves, grouped in separate chapters according to the type of damage caused. Within each chapter, keys are given to the groups of insects and the more important species within each group that may be concerned in damage, followed by information on the injury caused, geographical distribution, food range, appearance, life-cycle and control and pertinent references to the literature.

THOMSON (H. M.). **A Microsporidian parasite of the forest tent caterpillar, *Malacosoma disstria* Hbn.**—*Canad. J. Zool.* **37** no. 3 pp. 217–221, 1 fig., 7 refs. Ottawa, 1959.

Egg-masses of *Malacosoma disstria* Hb. from Ontario were found to be contaminated with Microsporidia that later infected the larvae and for which the name *Perezia disstriae*, sp. n., is proposed. The life-cycle of the parasite is described. The silk glands and the mid-gut epithelium were primarily attacked, but other tissues were also infected. Observations on the ejection of the polar filament are recorded.

LAIRD (M.). **Gregarines from laboratory colonies of flour beetles, *Tribolium castaneum* Herbst and *T. confusum* Duval, at Montreal.**—*Canad. J. Zool.* **37** no. 3 pp. 378–381, 9 refs. Ottawa, 1959.

In February 1959, heavy mortality was caused in laboratory colonies of *Tribolium castaneum* (Hbst.) and *T. confusum* Duv. at Montreal by a Gregarine parasite identified as *Triboliocystis garnhami*. Large numbers

of trophozoites, schizonts and spores were found in the larvae, where they occurred principally in the fat-body, commonly in the haemocoel, and also in the muscles. A species of *Gregarina* found in the intestine of the larvae was probably not pathogenic and may have been present in the colonies for some time.

FISHER (R. C.). **Life history and ecology of *Horogenes chrysostictos* Gmelin (Hymenoptera, Ichneumonidae), a parasite of *Ephestia sericarium* Scott (Lepidoptera, Phycitidae).**—*Canad. J. Zool.* **37** no. 4 pp. 429–446, 8 figs., 34 refs. Ottawa, 1959.

The following is based almost entirely on the author's abstract. *Angitia* (*Horogenes*) *chrysostictos* (Gmel.), a common parasite of Lepidopterous larvae, was reared in the laboratory in larvae of *Hofmannophila pseudospretella* (Stnt.), *Endrosis sarcitrella* (L.), *Galleria mellonella* (L.), *Achroia grisella* (F.), *Ephestia elutella* (Hb.), *Cadra* (E.) *cautella* (Wlk.) and *Anagasta kühniella* (Zell.), (*E. sericaria*, auct.) [cf. *R.A.E.*, A **34** 252]. The size and coloration of the adults and the period of preimaginal development were regulated by the size and species of the host and environmental temperature. The durations of the egg stage and the five larval instars are recorded. Characters are given distinguishing the first and fifth larval instars from those of *Nemeritis canescens* (Grav.), also a parasite of *A. kühniella*, and the rates of development of both species are compared over the viable range of 15–30°C. [59–86°F.]. The parasite developed more quickly at all temperatures. The ratio of males to females was usually 3:2; the reproductive potential was highest at 25°C. [77°F.], with a mean of 39.4 progeny per female. The adult behaviour in mating, host finding and oviposition is described. Supernumerary larvae in the first instar use their mandibles to fight for possession of the host, the older one surviving, and when first-instar larvae are present with others in later instars, their development is inhibited by the latter through the medium of the haemolymph of the host.

MCGINNIS (A. J.) & KASTING (R.). **Nutrition of the pale western cutworm, *Agrotis orthogonia* Morr. (Lepidoptera: Noctuidae). I. Effects of underfeeding and artificial diets on growth and development, and a comparison of wheat sprouts of Thatcher, *Triticum aestivum* L., and Golden Ball, *T. durum* Desf., as food.**—*Canad. J. Zool.* **37** no. 3 pp. 259–266, 2 graphs, 7 refs. Ottawa, 1959.

KASTING (R.) & MCGINNIS (A. J.). **II. Dry matter and nitrogen economy of larvae fed on sprouts of a hard red spring and a durum wheat.**—*T.c.* no. 5 pp. 713–720, 17 refs.

The following is virtually the authors' abstract of the first part of this paper. Larvae of *Agrotis orthogonia* Morr. provided with a continuous supply of Thatcher wheat sprouts required six instars to mature and increased in weight from 0.25 mg. to near 700 mg. in about four weeks. Larvae fed for only two hours each day required an additional instar, developed more slowly, and were smaller. The growth curves, based on daily mean weights of groups of larvae, were generally similar, as both exhibited a plateau before each moult, followed by a rapid rise. Of four artificial diets tested, only two containing wheat-leaf juice permitted weight increases. In further tests, the percentages of dry matter and nitrogen in the larvae varied according to the stage of larval development and the

variety of wheat sprouts used. These factors, as well as underfeeding, also influenced the efficiency with which the larva converted its food into body tissue.

The following is almost entirely the authors' abstract of the second part. Dry matter and nitrogen balances, determined for individual larval instars provided with a continuous supply of wheat sprouts, showed that reliable data were obtained for only the fourth, fifth and sixth instars. During its development, a single larva consumed about 10 g. fresh wheat sprouts containing about 25 mg. nitrogen. Of the consumed food, 40-50 per cent. of the dry matter and 60-70 per cent. of the nitrogen were excreted. Five days after the fifth moult, the fresh weights of larvae fed on sprouts of *durum* wheat of the variety Golden Ball were significantly less than those fed on sprouts of hard red spring wheat of the variety Thatcher, but the dry weights were the same. The quantities of nitrogen found in excreta and body tissue approximated that consumed by the larvae. In contrast, however, much of the consumed dry matter (14-33 per cent.) could not be accounted for; recovery varied with variety. The percentage of the dry matter utilised, about 50 per cent., remained constant during the last three instars. Nitrogen utilisation by fourth-, fifth-, and sixth-instar larvae ranged between 25 and 45 per cent. However, a consistently lower percentage of the nitrogen was utilised from Thatcher than from Golden Ball sprouts. On both varieties the lowest values were obtained in the sixth instar. In the excreta, the percentages of insoluble dry matter, insoluble nitrogen, and volatile bases showed no consistent change during the last four instars. Of the excreted nitrogen, 70-80 per cent. was soluble in 80 per cent. ethanol, and about one-fifth of this was in the form of volatile bases. The variety of wheat sprouts had little, if any, effect on the composition of the excreta.

FRIEND (W. G.), SALKELD (E. H.) & STEVENSON (I. L.). **Acceleration of development of larvae of the onion maggot, *Hylemyia antiqua* (Meig.), by microorganisms.**—*Canad. J. Zool.* **37** no. 5 pp. 721-727, 5 refs. Ottawa, 1959.

The following is virtually the authors' summary. On a chemical diet, larvae of *Hylemyia antiqua* (Mg.) developed more rapidly in the presence of various living bacteria, of certain non-viable bacterial cells, or of the dialyzate of these cells. The stimulation by the non-viable cells was not affected when the cells were disrupted by sonic treatment. Additions of ashed cells to the chemical diet had no stimulatory effect. Some stimulation in rate of development was noted on addition of casein to the diets but to a lesser degree than that caused by equivalent concentrations of non-viable cells. The growth rate and the rate of metamorphosis stayed in phase with one another when development was accelerated.

STARK (R. W.). **Climate in relation to winter mortality of the lodgepole needle miner, *Recurvaria starki* Free., in Canadian Rocky Mountain Parks.**—*Canad. J. Zool.* **37** no. 5 pp. 753-761, 1 map, 2 graphs, 6 refs. Ottawa, 1959.

The following is based on the author's summary. Winter weather in North America can be described in terms of four major air masses, tropical maritime (mT), polar maritime (mP), arctic maritime (mA), and arctic continental (cA). In the outbreak area of *Recurvaria starki* Freeman [cf. *R.A.E.*, **A 45** 479] on lodgepole pine [*Pinus contorta*] in western Canada,

the main circulation is from the north and west, which results in a predominance of mP and cA air. Local topography and its effect on winter climate are described for three areas in the Bow Valley of the Banff national park, Alberta, and a nearby one in the Yoho national park, British Columbia, that are permanent sampling areas for *R. starki*. Variations in winter mortality from year to year and between sampling areas are related to climate. Extensive invasions of cA air, particularly of long duration, cause lethal winter temperatures. Winter mortality usually occurs during the coldest month, January, and may be exceptionally high when extreme minima of -30 to -40°F . persist for long enough to depress the monthly mean temperature to about 0°F . However, less extreme temperatures in other months may result in similar high mortalities if they are unseasonably low. The climatic conditions causing high mortality generally occur at the tops of slopes and at valley bottoms, allowing the middle slopes to serve as 'refuge areas' for surviving populations of *R. starki* [cf. 43 304].

CHANT (D. A.). **Phytoseiid mites (Acarina: Phytoseiidae). Part I. Bionomics of seven species in southeastern England. Part II. A taxonomic review of the family Phytoseiidae, with descriptions of 38 new species.**—*Canad. Ent.* 91 suppl. 12, 166 pp., 306 figs., 5 pp. refs. Ottawa, 1959.

The family Phytoseiidae, as revised in the second part of this work, comprises two subfamilies, the Phytoseiinae, with eight genera, and the Macroseiinae, with only one. The Phytoseiine genera are *Typhlodromus* [cf. R.A.E., A 47 120], which is by far the largest and most important, *Phytoseius* and *Phytoseiulus*, which are also of considerable importance as predators of pests of plants, and five others which are of little significance. Keys are given to these eight, to their subgenera and to the species, those of *Typhlodromus* being arranged in various taxonomic groups, and there is also a systematic list of all the species, with their synonyms, characters and type localities; 38 of the species are new, and there is much new synonymy. As regards the species mentioned in this *Review*, *T. tiliae* Oudm. is a synonym of *T. pyri* Scheuten and *Amblyseius americanus* Garman [40 264] and *Scius quadripilis* Banks [5 242] are transferred to *Typhlodromus* and *Iphiseius*, respectively. When *Amblysciopsis* was combined with *Typhlodromus* [47 120], *T. floridanus* Muma [44 238] became a homonym of *T. (A.) floridanus* (Muma), and, since the latter has page priority, the name *T. helveolus*, n., is proposed for the former.

The first part of the work comprises an account of laboratory, insectary and field studies on the bionomics and ecology of predacious Phytoseiids in orchards and other habitats in south-eastern England in 1952–55, most of the results of which have already been noticed from less detailed sources [cf. 45 336; 47 489]. The following is largely based on the author's summary. None of the seven species studied exhibited plant-specificity, though certain habitats might be preferred. Winter mortality was severe, and there were seldom more than two or three adults of *T. pyri* per leaf. Though *T. pyri* can develop and reproduce on fungi and pollen, it did not do so when only apple leaves were provided as food [cf. 48 155]; if the larvae consumed even a small number of larvae of *Panonychus ulmi* (Koch) at the beginning of their development, however, they could complete it on a subsequent diet of apple leaves. In the absence of plant material, approximately 25 larvae of *P. ulmi* were required for development. Insectary rearings of four common species, *T. pyri* (the only one abundant in commercial orchards), *T. finlandicus* (Oudm.) (common in unsprayed orchards), *T. bakeri* (Garman)

(a bark-inhabiting species not previously recorded from England) and *Phytoseius macropilis* (Banks) (of general distribution) showed that they complete their development in 16.2, 17.8, 19.8 and 21.5 days, respectively. The population trends of *T. pyri* in an unsprayed apple orchard during 1954 and 1955 and of *T. finlandicus* and three other species in various habitats in 1955 are described. Consideration of the distribution of *T. pyri* and *Panonychus ulmi* on the leaves, shoots and spurs [cf. 45 336] and of the feeding habits of *T. pyri* indicated that this species is inefficient and partially ineffective as a predator. This conclusion was confirmed by observations in the field, where the rate of increase of *T. pyri* was similar in both the presence and absence of *P. ulmi*. It was further substantiated in orchard experiments in 1954 and 1955, in which numbers of *P. ulmi* were not significantly higher on trees on which populations of *T. pyri* had been reduced by the removal of sacking bands under which the predators were overwintering and exposure to a spray of DNC and oil emulsion on 22nd March than on trees on which the bands remained undisturbed. Evidence was obtained that *T. finlandicus* inhibited the increase of *T. pyri* and *Phytoseius macropilis*, but was possibly a more effective predator than any of the others.

MACLELLAN (C. R.). **Woodpeckers as predators of the codling moth in Nova Scotia.**—*Canad. Ent.* 91 no. 11 pp. 673–680, 2 graphs, 7 refs. Ottawa, 1959.

The following is almost entirely the author's summary. Analyses showed that woodpeckers (*Dendrocopos villosus villosus* and *D. pubescens medianus*) were efficient predators of overwintering larvae of the codling moth [*Cydia pomonella* (L.)] on apple in Nova Scotia [cf. R.A.E., A 47 237] and exhibited intraspecific competition. Woodpeckers frequently reduced the pest population in orchards to a level where other natural control agents were able to prevent the succeeding generation from damaging the fruit to an uneconomical degree. The numbers of woodpeckers, which never exceeded four per location, were estimated in 33 orchards for the years 1954–58. Two methods of study, namely sight records and observations on signs of feeding activity, showed that these birds live in permanent feeding zones that vary in size according to the food available. In areas that undergo little or no physical change, the numbers of woodpeckers may remain steady for several years.

SMITH (R. W.). **Status in Ontario of *Collyria calcitrator* (Grav.) (Hymenoptera: Ichneumonidae) and of *Pediobius beneficus* (Gahan) (Hymenoptera: Eulophidae) as parasites of the European wheat stem sawfly, *Cephus pygmaeus* (L.) (Hymenoptera: Cephidae).**—*Canad. Ent.* 91 no. 11 pp. 697–700, 4 refs. Ottawa, 1959.

The following is based mainly on the author's summary. *Cephus pygmaeus* (L.) was first recorded damaging wheat in Ontario in 1938, and moderate or heavy infestations were found in several localities in the south-central part of the Province in 1939. *Collyria calcitrator* (Grav.), an important parasite of wheat sawflies in Europe, was introduced from England into the Prairie Provinces, especially Saskatchewan, against *Cephus cinctus* Nort. on wheat during 1930–39 [cf. R.A.E., A 20 96] and was also released against *C. pygmaeus* in Ontario in 1940. Average annual parasitism by this Ichneumonid in Ontario reached 8 per cent. by 1945 and

27 per cent. by 1949. A survey in 1958 showed that the average parasitism was 47 per cent., and that the parasite had spread from some of the original release areas. Increased parasitism by this species was associated with a decrease in parasitism by *Pediobius beneficus* (Gah.), another internal parasite, probably of European origin and introduced with the sawfly. Although some 500,000 adults of *Collyria calcitrator* were liberated in the Prairie Provinces during 1930-39, there was no evidence of its permanent establishment there.

SWAILES (G. E.). **Resistance in rutabagas to the cabbage maggot, *Hylemya brassicae* (Bouché) (Diptera: Anthomyiidae).**—*Canad. Ent.* **91** no. 11 pp. 700-703, 2 refs. Ottawa, 1959.

Of 15 varieties of swede tested for resistance to *Hylemya brassicae* (Beh.) in southern Alberta in 1955-58, one was resistant to both the establishment and the development of the larvae and the one commonly grown appeared to have some resistance to the larvae and to oviposition. The most susceptible variety was one of the fastest growing [*cf. R.A.E.*, A **33** 178].

JUILLET (J. A.). **Morphology of immature stages, life-history, and behaviour of three Hymenopterous parasites of the European pine shoot moth, *Rhyacionia buoliana* (Schiff.) (Lepidoptera: Olethreutidae).**—*Canad. Ent.* **91** no. 11 pp. 709-719, 31 figs., 6 refs. Ottawa, 1959.

The following is based almost entirely on the author's summary of this account of investigations on the bionomics of *Ephialtes ruficollis* (Grav.), *Campoplex* (*Eulimneria*) *rufifemur* (Thoms.) and *Tetrastichus turionum* (Htg.), which were introduced from Europe and released in southern Ontario against *Rhyacionia buoliana* (Schiff.) on pines in 1955-57 [*cf. also R.A.E.*, A **43** 156]. The immature stages of all three are described; the first is an external and the second an internal parasite of the larvae, and the third is an internal parasite of the pupae.

Ephialtes ruficollis overwinters as a mature larva. Males and females survived in the laboratory for 26 and 52 days, and the egg, larval and pupal stages lasted 2-3, 10-15 and 7-13 days, respectively. The adults flew at 60-85° F., flight being reduced in wind above 5 miles per hour, and usually paired in the first few hours after the female emerged. The average number of eggs laid per female was 23, the reproductive potential being estimated at about 82 eggs. The females punctured host larvae and fed on their juices, thus reducing the amount of food available for the parasite larvae; also, they fed avidly on pine resin. The average distance travelled in one day was 120 ft. under favourable and 40 ft. under unfavourable conditions.

C. rufifemur overwinters as a first-instar larva. Males and females survived for 13 and 27 days, and the egg, larval and pupal stages lasted 3-4, 310 and 20 days, respectively. The adults flew at temperatures of 65-85° F., wind above 5 miles per hour reducing flight. No flight occurred during cloudy intervals. The females usually paired on emergence, and the average number of eggs laid per female was 24. The adults fed on pine resin and on the inflorescences of wild carrot (*Daucus carota*). The average distance covered in one day was 70 ft. under favourable and 30 ft. under unfavourable conditions.

T. turionum overwinters as a mature larva. The males and females survived for 16 and 27 days, and the egg, larval and pupal stages lasted 2, 320 and 10 days, respectively. The adults mated readily at temperatures

above 70°F. Pairing occurred before or immediately after the escape of the female from the host and five females provided with 13 host pupae laid an average of 45 eggs each. Adults that were fed daily survived for twice as long as those that were unfed.

PUTMAN (W. L.). **Hibernation sites of Phytoseiids (Acarina: Phytoseiidae) in Ontario peach orchards.**—*Canad. Ent.* **91** no. 11 pp. 735-741, 5 refs. Ottawa, 1959.

Some Phytoseiid mites predacious on Tetranychids have been reported to hibernate in the bark of trees, but the taxonomy of the groups has until recently been so confused that the identity of the species concerned was uncertain. Observations were made on the hibernation sites of nine Phytoseiids during a study of predacious arthropods in peach orchards in the Niagara Peninsula, Ontario, during 1952-58, and the following is based on the author's summary of the results. *Typhlodromus rhenanus* (Oudem.) hibernates chiefly in cankers on the limbs, *T. pyri* Scheuten in cankers and on the trunks, *T. andersoni* Chant on both trees and ground litter, and *T. fallacis* (Garman) and *T. cucumeris* Oudem. chiefly in litter or soil. All species hibernating on the trees, except *T. cucumeris*, also occupied empty scales of *Eulecanium* (*Lecanium*) spp. Hibernating Phytoseiids usually occur in groups, sometimes of 2-3 species, which may be social aggregations. Cocoons of Lepidoptera and their contained insect remains, and cavities in or under dead Coccids, were among the sites most frequently occupied. An experiment showed that the mites were attracted to fragments of cocoons of *Cydia* (*Grapholitha*) *molesta* (Busck).

MCGINNIS (A. J.) & KASTING (R.). **Note on a method of comparing diets for the pale western cutworm, *Agrotis orthogonia* Morr. (Lepidoptera; Noctuidae).**—*Canad. Ent.* **91** no. 11 pp. 742-743, 3 refs. Ottawa, 1959.

Initial evaluation of the nutritional adequacy of diets for *Agrotis orthogonia* Morr., which has been successfully reared in the laboratory on various foods [cf. *R.A.E.*, A **48** 68], has been obtained from comparisons of growth curves based on the daily mean weights of groups of larvae [cf. **49** 187]. An experiment here described showed that the relative value of the diets can be as satisfactorily determined from simplified curves based on mean weights recorded two days after each moult, when variability within the population is least.

MCGUGAN (B. M.) & BLAIS (J. R.). **Spruce budworm parasite studies in northwestern Ontario.**—*Canad. Ent.* **91** no. 12 pp. 758-783, 3 figs., 37 refs. Ottawa, 1959.

A detailed account is given of studies in 1946-56 on the parasites that attack *Choristoneura fumiferana* (Clem.) in north-western Ontario. Samples were collected each year in plots of balsam fir [*Abies balsamea*] in the outbreak area of Lake Nipigon and of *A. balsamea* and to some extent white spruce [*Picea glauca*] in that of Lac Seul at three or four predetermined stages in the development of the host [cf. *R.A.E.*, A **45** 77], and the data were analysed by a technique making use of the mortality-survival ratio [cf. **37** 95-96], which is described. The following is largely based on the authors' discussion and conclusions.

In all, 30 primary parasites, comprising 20 species of Hymenoptera and ten of Diptera and including four not previously recorded from *C. fumiferana*, were reared, bringing the total number of known parasites of the immature stages to about 92. Hyperparasites were not uncommon, but apparently did not limit the importance of any primary parasite. A comparison of the results with those obtained elsewhere [cf. 38 100, 487; 41 207, etc.] showed that the important elements consisted of the same 12-15 species and that the remaining parasites varied considerably in number and abundance from region to region. The variations within and between plots in the two outbreak areas were of three kinds. Some species were invariably present and showed differences only in relative abundance, others showed strong regional or plot preferences, and a third group appeared to be associated with certain periods in the outbreak sequence. The complex as a whole caused fairly constant mortality, and only a few species, notably *Meteorus trachynotus* Vier., appeared to be sufficiently variable to afford extra control.

Extensive tree mortality occurred in both areas, and the evidence from past outbreaks confirms that parasites and other natural control agents do not become operative until after large areas of forest have been killed. When the combination of a susceptible forest and suitable climatic sequence [cf. 39 151; 40 380] has initiated an outbreak, the population of *Choristoneura* rapidly outstrips even control factors that react to increased host density. All the balsam fir and most of the white spruce at or near the focus and most of the balsam fir and much of the white spruce in a broad area surrounding it eventually die as a result of repeated defoliation [cf. 37 270], though in the peripheral zone balsam fir in young open stands or forming a small component of mixed stands may survive with loss of increment. Food supply then becomes the prime limiting factor for *C. fumiferana*, though some parasites show increases that appear to hasten the collapse of the outbreak.

In the Lake Nipigon area, where the outbreak had almost died out by 1956, populations declined simultaneously over the whole area; those in the large peripheral zone became near-endemic, despite an adequate food supply, and the trees subsequently recovered. At the time of the collapse, parasites were considerably more numerous at the periphery than they had been earlier at the focus, and they evidently contributed to the decline; subsequent local increases in host populations were promptly accompanied by increases in parasite numbers. At Lac Seul, where the outbreak was still in active progress and the pattern of activities at the focus was similar to that at Lake Nipigon, the observed increases in parasite numbers did not coincide with a general collapse and could be accounted for by the reduction in host numbers following severe tree mortality; a general collapse of this outbreak is considered unlikely, since it is too extensive and the conditions within the area too diverse for it to react as a whole. The different courses in the two areas may be related to the different types of forest concerned; at Lake Nipigon the affected forests were relatively homogeneous and contained extensive stands of mature balsam fir, whereas at Lac Seul they contained a high proportion of pines and deciduous trees, and though balsam fir was common, it occurred primarily in relatively small stands, often of young vigorous trees. The rôle of parasites under the conditions prevailing at Lac Seul is uncertain, but the average parasitism was consistently lower (35 per cent.) there than it was at Lake Nipigon (52 per cent.) and Dipterous parasites were less common. The relatively low incidence of parasites at Lac Seul may be a factor contributing to the present status of the outbreak. It appears that at least some species are important control agents, but extensive tree mortality is nevertheless a normal consequence of outbreaks of *C. fumiferana* in eastern Canada. Attempts to introduce parasites have

been unsuccessful, but the large-scale application of insecticides has met with some success [cf. 36 33; 43 83; 45 401]. The value of control through forest management has not been adequately demonstrated, and knowledge of the detailed requirements of the more important parasites might be of value in this connection.

SMEREKA (E. P.) & HODSON (A. C.). **Some humidity and light reactions of the granary weevil, *Sitophilus granarius* (L.) (Coleoptera: Curculionidae).**—*Canad. Ent.* 91 no. 12 pp. 784-797, 8 figs., 17 refs. Ottawa, 1959.

The following is virtually the authors' summary of the laboratory investigations described. Adults of *Sitophilus granarius* (L.) sifted from wheat reacted to differences in relative humidity. Conditioning at 0 per cent. relative humidity produced a wet reaction and conditioning at 100 per cent. relative humidity produced an initial dry reaction that changed to a wet one after several hours. The intensity of reaction was influenced by the humidity gradient and position on the humidity scale; the larger the gradient and the wetter the alternatives, the more intense the reaction. The beetles were more active at lower humidities, but remained alive for longer periods at higher humidities. They orientated themselves to humidity by hygrokinesis and klinokinesis and were initially photonegative, but became positive if left undisturbed. Smaller groups became photopositive quicker than larger groups, and groups at lower humidities quicker than groups at higher humidities. A reversal of the photopositive reaction occurred at 11-7°C. [51.8-44.6°F.] and 0 per cent. relative humidity. An interaction between light and humidity occurred when the humidity alternatives were at the wet end of the humidity scale and the humidity gradient was 30 per cent.

MUTCHMOR (J. A.). **Some factors influencing the occurrence and size of the midsummer flight of the European corn borer, *Ostrinia nubilalis* (Hbn.) (Lepidoptera: Pyralidae), in southwestern Ontario.**—*Canad. Ent.* 91 no. 12 pp. 798-806, 4 graphs, 14 refs. Ottawa, 1959.

In south-western Ontario, two flights of *Ostrinia nubilalis* (Hb.) occur each year [cf. *R.A.E.*, A 43 154], of which the first is derived from overwintered larvae and begins in June and the second, due to first-generation adults, begins in late July or early August. Data obtained in 1932-51 showed that the size of the second flight was very variable. The factors influencing it were studied in 1957-58, and the following is virtually the author's summary of the findings.

Day-length appears to be a factor governing the induction of diapause in larvae of *O. nubilalis* [cf. 48 529]. The onset of day-lengths sufficiently short to induce diapause is in the latter half of July. Hatching-date in the spring, by limiting the time available for development, is a factor determining whether larvae enter the final instar before or after the advent of diapause-inducing conditions and, therefore, whether they enter diapause or contribute to production of the midsummer flight. The earliness of the first (spring) flight should have a similar effect; analysis of light-trap records revealed a moderately high degree of inverse correlation between the earliness of the first flight and the size of the midsummer flight. A high degree of inverse correlation was found between minimum spring temperatures and the earliness of the first flight. Minimum spring temperatures at Chatham,

Ontario, underwent a general increase in the period 1921–57, and since 1938 have been generally above the average for the period. It is suggested that the change from the one- to the two-generation habit shown by *O. nubilalis* in Ontario resulted from climatic changes rather than from a reversal of dominance of voltine strains.

HERBERT (H. J.). **Note on feeding ranges of six species of predaceous mites (Acarina: Phytoseiidae) in the laboratory.**—*Canad. Ent.* **91** no. 12 p. 812. Ottawa, 1959.

Females of several predacious Phytoseiid mites were offered overwintered and summer eggs, larvae, green nymphs and adults of *Panonychus ulmi* (Koch) and the species of *Bryobia* referred to in Canada as *B. arborea* Morgan & Anderson [cf. *R.A.E.*, A **47** 118], eggs, nymphs and adults of *Tetranychus telarius* (L.) and adults of *Aculus* (*Vasates*) *schlechtendali* (Nal.) in a laboratory experiment to determine their feeding ranges. *Typhlodromus pyri* Scheuten (*tiliae* Oudm.) fed on all the stages tested. *T. finlandicus* (Oudm.), *T. rhenanus* (Oudm.) and *Phytoseius macropilis* (Banks) fed on all but the overwintered eggs of *Panonychus ulmi* and *B. arborea* and, in the case of the last two, the adults of *Tetranychus telarius*. *Typhlodromus corticis* Herbert fed on all stages of *P. ulmi*, *B. arborea* and *A. schlechtendali* and the eggs of *Tetranychus telarius*, and *Typhlodromus fallacis* (Garman) on the three stages of *Tetranychus telarius*.

FOX (C. J. S.). **Note on the effect of spring flooding on a population of wireworms (Coleoptera: Elateridae).**—*Canad. Ent.* **91** no. 12 p. 813, 2 refs. Ottawa, 1959.

Data based on soil samples taken in old grassland in Nova Scotia in 1953–58 showed that the average number of wireworms (principally *Agriotes mancus* (Say)) per sq. ft. was significantly higher (11.8) in an area that was flooded for three weeks each spring than in the surrounding unflooded area (9.2). There appeared to be fewer Carabid larvae in the flooded area, and this may have enabled more wireworms to survive. The results confirm earlier findings that low, moist ground is more attractive to ovipositing females or permits greater larval survival than higher and drier ground [cf. *R.A.E.*, A **23** 323] and that prolonged flooding in spring favours increased populations.

TANSKIĬ (V. I.). **The basis of cultural methods of control of the wheat thrips, *Haplothrips tritici* Kurd. (Thysanoptera, Phloeothripidae), in northern Kazakhstan.** [In Russian.]—*Rev. Ent. URSS* **37** pt. 4 pp. 785–797, 3 figs., 23 refs. Moscow, 1958. (With a summary in English.)

Haplothrips tritici Kurd. is a serious pest of spring-sown wheat in the recently cultivated lands of northern Kazakhstan. In 1954–56, when observations were made, the adults appeared in mid-June and the females laid up to 20–22 eggs each on the immature ears. The nymphs hatched at the beginning of July, at the time of grain formation, but left the ears before harvest and hibernated either in the soil, at a depth of about 4 in., or in the stubble near the roots. In May, they came to the upper soil layer for pupation, and nymphs, pupae and adults were all observed in the soil in June. Considerable mortality occurred during metamorphosis, 53.7, 39.7

and 12 per cent. of the thrips dying in fallow, wheat and perennial grass fields, respectively; though temperature and moisture in the last were more favourable for development. Autumn ploughing resulted in 30-60 per cent. mortality of the overwintering nymphs, and breaking up the soil, which exposed them to frost, gave 65-75 per cent. kill. The rotation of wheat with annual grasses instead of with perennial ones is recommended, and further control can be gained by shortening the sowing period, thus reducing the time favourable for oviposition.

KOSMACHEVSKIĬ (A. S.). **On the feeding of click-beetle larvae (Coleoptera, Elateridae).** [In Russian.]-*Rev. Ent. URSS* 37 pt. 4 pp. 798-806, 8 refs. Moscow, 1958. (With a summary in English.)

The following is based on the author's summary. Laboratory experiments were carried out in Krasnodar on the food requirements of the larvae of *Agriotes sputator* (L.) and *A. litigiosus* var. *tauricus* Heyden. Development lasted up to 300 days when the larvae of both were fed on germinating wheat at mean temperatures of 18-27°C. [64.4-80.6°F.], and up to 530 days when they were fed from the second instar on potato tubers at the same temperatures. Larvae fed throughout on potato died before pupation, those starved for seven days after hatching completed their development on wheat, but those starved for 18 days died 40-65 days after food was provided. Starvation of late-instar larvae taken in the field resulted in death. Some that were placed singly in soil containing humus but no living plants died after a few days, and cannibalism occurred among others confined in groups of ten in jars without food. The fecundity of the females reared from cannibal larvae was normal.

VORZHEVA (L. V.). **On the bionomics of some little-known Microlepidoptera and their injuriousness to fruit trees in Cisbaikalia.** [In Russian.]-*Rev. Ent. URSS* 37 pt. 4 pp. 820-828, 4 figs., 7 refs. Moscow, 1958. (With a summary in English.)

An account is given of observations in the south of the Irkutsk region, in eastern Siberia, on three Tortricid pests of apple about which little was previously known. *Syndemis (Cacoecia) musculana* (Hb.), which is polyphagous and also attacks pear, was very injurious in 1953. The pupae overwinter in cocoons in the soil and give rise to adults in late May or early June. Eggs are laid on the leaves, and the larvae hatch at the beginning of June, feed on the leaves, and then on the fruits and, in October, migrate to the soil and pupate. *Ancyliis selciana* (Gn.) is limited by its preference for high humidity [cf. *R.A.E.*, A 35 379]. The eggs are laid singly on the lower surfaces of the leaves, and the larvae, which hatch after 12-14 days, in July, feed for 30-32 days on the leaves, after which they fall to the ground with the latter, overwinter among them and pupate in the following spring. Overwintered adults of *Anthophila (Simacthis) pariana* (Cl.) appear in May, feed on nectar and, at the end of the month, lay eggs on the upper surfaces of the leaves of several trees, notably apple and pear. The larvae feed on the leaves, which they roll, and pupate in cocoons spun near the mid-ribs. Adults of this generation emerge in July, and lay a large number of eggs, which hatch in a few days. The larvae feed as before and give rise to adults in August-September; these overwinter beneath the bark or among fallen leaves.

BOLDARUEV (V. O.). *Rhogas dendrolimi* Mats. (Hymenoptera, Braconidae), an effective parasite of *Dendrolimus sibiricus* Tshetv. [In Russian.]—*Rev. Ent. URSS* 37 pt. 4 pp. 829–835, 4 figs., 3 refs. Moscow, 1958. (With a summary in English.)

The following is based on the author's summary. Investigations were carried out in 1947–55 on the bionomics of *Rogas dendrolimi* (Mats.), which parasitises the larvae of *Dendrolimus superans* (Btlr.) (*sibiricus* Chtv.) on conifers in Siberia [cf. *R.A.E.*, A 43 106–107]. The eggs of the parasite are laid in second-instar hosts, which are present about 10th August, and the larvae hatch in 15 days and remain for over 20 months in the first instar, overwintering twice in diapause. In the laboratory, where development was continuous, the first instar was completed in five months. The second and third instars last about 10 and 20 days, respectively. Pupation occurs gradually in the mummified larvae of the host during June and early July and males emerge about ten days before females. Pairing occurs soon after emergence, but the females do not oviposit until they have fed for 25–30 days on honeydew. At densities of up to 500 larvae of *D. superans* per tree, parasitism reached 65–85 per cent., but the parasite cannot control an outbreak without the aid of *Telenomus gracilis* Mayr, which parasitises the eggs of *D. superans*, or *Masicera zimini* Kolomiets, another parasite of the larvae [cf. 43 106].

SHUTOVA (N. N.). The Tachinid, *Centeter ussuriensis* Rohd. (Diptera, Larvaevoridae), a parasite of the Japanese opal beetle, *Maladera japonica* Motsch. (Coleoptera, Scarabaeidae). [In Russian.]—*Rev. Ent. URSS* 37 pt. 4 pp. 836–845, 7 figs., 7 refs. Moscow, 1958.

An account is given of observations carried out in the Maritime Province of the Soviet Far East on the bionomics of *Hyperecteina* (*Centeter*) *ussuriensis* (Rod.), which parasitises the adults of *Maladera* (*Aserica*) *orientalis* (Motsch.) [cf. *R.A.E.*, A 41 52] and *M. (A.) japonica* (Motsch.), together with descriptions of the immature stages. The pupae of the Tachinid overwintered in the soil and gave rise to adults when the temperature reached 10°C. [50°F.] in mid-May; mass emergence continued until mid-June. First-generation eggs, which were laid on the integument of *M. orientalis*, were first observed on 13th–15th May. The larvae hatched in 3–4 days, penetrated the host and became full-fed by the beginning of June. Adults emerged at the beginning of July and oviposited on *M. japonica*, the adults of this second generation emerging at the end of July or the beginning of August. The third (overwintering) generation also developed in *M. japonica*. In accordance with the habits of their hosts, the ovipositing females of the overwintered generation of the Tachinid were active in the evening and those of the first and second generations at night. Since adults of *M. japonica* are present in the Caucasus region from May to September, *H. ussuriensis* was sent there from the Maritime Province in 1951–52 and released against them in Georgia.

ISAKOVA (N. P.). The effect of a spore-producing bacterium of the type of *Bacillus cereus* Fr. on some injurious insects. [In Russian.]—*Rev. Ent. URSS* 37 pt. 4 pp. 846–855, 10 refs. Moscow, 1958. (With a summary in English.)

In 1954–55, the pathogenicity of *Bacillus cereus* var. *galleriae* [cf. *R.A.E.*, A 48 241] to various insect pests of plants, chiefly Lepidopterous larvae, was

tested in the laboratory by a feeding technique. It proved pathogenic to many of the Lepidoptera, slightly so to *Nematus (Pteronidea) ribesii* (Scop.) and harmless to insects of other orders. Although pathogenic to *Pieris brassicae* (L.) and *P. rapae* (L.), it did not affect adults of their respective parasites, *Apanteles glomeratus* (L.) and *Pteromalus puparum* (L.). In field tests in the Leningrad region, in which spore suspensions were applied as sprays against several Lepidoptera, up to about 95 per cent. mortality of *Pieris brassicae* on cabbage and *Hyponomeuta padellus malinellus* Zell. on apple was obtained.

MASLENNIKOVA (V. A.). **On the problem of the overwintering and diapause of Trichogrammatids** (*Trichogramma evanescens* Westw.). [In Russian.]—*Vest. lenigr. Univ.* **14** no. 3 (Ser. Biol. pt. 1) pp. 91–96, 2 graphs, 4 refs. Leningrad, 1959. (With a summary in English.)

Trichogramma evanescens Westw. is reared in the laboratory in the Soviet Union in winter and the resulting adults are stored at low temperature for release in spring. Since they do not survive for more than 1–2 months at 1–2°C. [33.8–35.6°F.], losses are considerable. The full-fed larvae are known to enter prolonged diapause at low temperatures, however [cf. R.A.E., A **16** 43], and would provide a better source of material for spring release. The conditions determining the onset of diapause were therefore investigated in the winter of 1957–58.

Batches of eggs of *Sitotroga cerealella* (Ol.) exposed to parasitism for two days at 20°C. [68°F.] were kept at 10, 15 or 20°C. [50, 59 or 68°F.] under conditions of continuous light, 12 hours light per day, or total darkness; 10 days after emergence of adult parasites had ceased, the remainder were dissected, and the percentages of larvae in diapause were determined. A further series was kept at 25°C. [77°F.] and 12–14 hours light per day. The results showed that 95–97 per cent. of the larvae entered diapause at 10°C., regardless of the light conditions; only 3–6 per cent. did so at 20°C., and all larvae developed without diapause at 25°C. At 15°C., the parasites proved sensitive to light, 16, 66 and 76 per cent. entering diapause under the three conditions, respectively. To study the effect of alternating temperatures, eggs of *Apanteles (Acronicta) rumicis* (L.) parasitised by *T. evanescens* were kept during the summer of 1957 at 23°C. [73.4°F.] by day and at 4–5°C. [39.2–41°F.] at night. After 17–19 days, parasite adults had emerged from all the eggs. When the eggs were kept at 15°C., 37 per cent. of the parasite larvae entered diapause.

Experiments were also carried out on the cold-hardiness of the larvae. In the first, eggs of *S. cerealella* containing them were cooled in the course of an hour from 16°C. [60.8°F.] to temperatures ranging from –5 to –35°C. [23 to –31°F.] and then immediately transferred to 20°C. and kept for emergence, after which the remainder were dissected. Normal larvae reared at 25°C. were tested one day before pupation, when their stage of development would correspond to that of larvae in diapause, and it was found that cooling to –5 or –10°C. [14°F.] caused negligible mortality, cooling to –15 or –20°C. [5 or –4°F.] caused 29 and 70 per cent., respectively, and cooling to –25°C. [–13°F.] or below caused complete kill. For larvae in diapause, reared at 10°C., cooling to temperatures down to –25°C. caused negligible mortality, and the percentages killed were only 18 and 62 at –30°C. [–22°F.] and –35°C. In the second experiment, the effect of longer exposures was tested. The parasitised eggs were exposed to –20°C. for 48 or 120 hours, and mortality was complete for normal larvae and negligible for those in diapause. It is concluded from the work that larvae in diapause are the most suitable stage for prolonged storage.

BJEGOVIĆ (P.). **Sedlasta mušica štetočina žita na teritoriji NR Srbije.** [The saddle fly, a pest of cereals in Serbia.]—*Plant Prot.* no. 39–40 pp. 3–11, 21 refs. Belgrade, 1957. (With a summary in English.)

Haplodiplosis equestris (Wagn.), which was first observed in Serbia in 1953 and has principally infested wheat, was found in 1957 on rye in the north-east of the country, especially on high ground, causing up to 80–90 per cent. loss of crop. The great majority of the larvae attacked the leaf-sheaths on the third and fourth internodes, of which 80.6 and 84 per cent., respectively, were infested. Infestation of barley was also extensive.

All stages of the Cecidomyiid are described. The adults emerge at the end of May or the beginning of June and live for two days, during which pairing and oviposition occur. Up to 421 eggs were found in individual females, but the average was 257. The full-fed larvae enter the soil at the end of June in the lowlands and a month later in the uplands and overwinter at depths of about 1–4 in. Pupation occurs in spring close to the soil surface.

MIJUŠKOVIĆ (M.) & MIRČETIĆ (S.). **Mogućnost suzbijanja maslinove mušice parationskim sredstvima.** [Possibility of controlling the olive fly by means of parathion.]—*Plant Prot.* no. 39–40 pp. 23–42, 3 graphs, 13 refs. Belgrade, 1957. (With a summary in French.)

An account is given of experiments carried out in 1954–56 on the coast of Montenegro, Yugoslavia, on the control of *Dacus oleae* (Gmel.) on olives by means of parathion. It was found that a 0.05 per cent. emulsion spray gave excellent results, but that stronger ones of 0.07 and 0.1 per cent. had a more prolonged effect. The latter are recommended. Two applications should be made in years of early and severe infestation.

HANUSS (K.). **Untersuchungen über den Klee-Luzernerüssler *Brachyrhinus* (*Otiorrhynchus*) *ligustici* L.** [Investigations on *Otiorrhynchus ligustici*.]—*Z. angew. Ent.* 43 pt. 3 pp. 233–281, 20 figs., 40 refs. Hamburg, 1958. (With a summary in English.)

Infestation of red clover (*Trifolium pratense*) by *Otiorrhynchus* (*Brachyrhinus*) *ligustici* (L.) in parts of southern Germany increased in 1946–51 and serious injury to the crop occurred in 1951. All stages of this weevil are described, its distribution and food-plants are reviewed, and a detailed account is given of investigations on its bionomics carried out near Stuttgart in 1951–54, the results of which are compared with those obtained elsewhere [cf. *R.A.E.*, A 41 187; 43 338, etc.].

The adults (comprising only parthenogenetic females) emerged from the end of June to the end of July, but remained in the pupal cells until the soil temperature reached 3.5°C. [38.3°F.] in the following spring. They appeared from late March to early May, and their feeding caused considerable damage to young plants, though not to older ones. They re-entered the soil in bad weather, and mass migrations of the weevils, which do not fly, were not observed. Oviposition began when the temperature exceeded 13°C. [55.4°F.], and, in the laboratory, at 18–20°C. [64.4–68°F.], an interval of 13 days elapsed between the appearance of the adults and egg-laying. The optimum temperatures for the latter were 15–20°C. [59–68°F.], and temperatures of 24–30°C. [75.2–86°F.] impeded it. Eggs

were usually laid on the roots in the upper two inches of soil, and individuals kept out of doors in an average temperature of 14.5°C. [59.9°F.] laid 476 in 74 days. Suppression of oviposition by short periods of cool weather had no effect on the total number of eggs laid, but suppression by longer periods did. Of weevils taken from clover or lucerne near Stuttgart (where lucerne was lightly infested) or from lucerne near Halle (where infestation was widespread), those that were then fed on lucerne laid fewer eggs than those fed on clover.

Eggs developed in the laboratory at temperatures between about 10 and 30°C. [50 and 86°F.] and at soil humidities between 5 and 40 per cent. The period required was 9 days at 29.1°C. [84.4°F.] (the shortest recorded) and about 12–24 days at 16–21°C. [60.8–69.8°F.] (the optimum temperature range), but some of the eggs failed to hatch at normal temperatures outdoors and even under optimum conditions in the laboratory, and mortality was higher still when the adults were exposed to low temperatures before oviposition. The larvae fed on the roots, and their rate of development varied with temperature. Most of them became full-fed in the year in which they hatched, but some overwintered, descending deeper into the soil, and fed again in the following year and possibly even during a third year. In the laboratory, at 23°C. [73.4°F.] and 15–20 per cent. soil humidity, development to the sixth moult required an average of about 89 days and the rest of the larval stage 150 days. Development ceased above 24°C. or below 6°C. [42.4°F.], and temperatures of less than –5°C. [23°F.] were fatal. The larvae pupated deep in the soil in the spring or summer following completion of larval development. Greenhouse tests showed that, apart from lucerne, *Medicago lupulina*, white clover [*T. repens*], crimson clover (*T. incarnatum*) and *Lotus corniculatus* were attacked; the larvae also developed on carrot, although it was not acceptable to the adults.

The environmental and climatic factors conducive to infestation and the reasons for the increase, together with possible methods of control, are discussed. It is considered that warm, dry weather in May–October, which favours oviposition, is necessary for the occurrence of an outbreak.

MACKAUER (M.). **Zur Kenntnis der paläarktischen Aphidiinae (Hym., Braconidae). 1. Beitrag: Die wirtschaftliche Bedeutung von *Aphidius ribis* Hal.** [Contribution to knowledge of the palaearctic Aphidiines. 1. The economic importance of *A. ribis*.]—*Z. angew. Ent.* **43** pt. 3 pp. 282–285, 2 graphs, 7 refs. Hamburg, 1958. (With a summary in English.)

Capitophorus (Cryptomyzus) ribis (L.) sometimes causes considerable injury to currants in Germany. In observations on black currant near Wiesbaden in 1957 to determine the effectiveness against it of *Aphidius ribis* Hal., its only known parasite of any importance in Europe, adult parasites appeared in late May and parasitism rose to an average of 17 per cent. at the beginning of July (maximum 40 per cent.), declining thereafter, and no adult parasites were seen after about the end of July. About 20 per cent. of parasitised aphids that were collected weekly gave rise to adults of *A. ribis*, and some 60 per cent. to hyperparasites (mainly a Cynipid, possibly *Charips (Allotria) minuta* (Htg.)), but no insects emerged from the remainder. Although its rate of increase and velocity of development render *Aphidius ribis* suitable as a parasite of *Capitophorus ribis*, its higher optimum temperature as compared with that of its host and its restricted powers of spread reduce its effectiveness.

RÜHM (W.). **Zur mechanisch-chemischen und ökologischen Bekämpfung des Riesenbastkäfers (*Dendroctonus micans* Kug.) (eine zusammenfassende Darstellung).** [On the mechanical-chemical and ecological control of *D. micans* (a comprehensive account).]—*Z. angew. Ent.* **43** pt. 3 pp. 286–325, 8 figs., 36 graphs, 30 refs. Hamburg, 1958. (With a summary in English.)

Infestation of spruce (*Picea abies* and *P. sitchensis*) by *Dendroctonus micans* (Kug.) has increased in Schleswig-Holstein since 1939, and investigations were begun in 1953 in two localities near Flensburg on the possibility of using chemicals in addition to mechanical methods for control of the Scolytid. The reasons rendering the introduction of chemicals necessary and cultural measures alone, such as felling, barking and burning, unsatisfactory, the properties required of any insecticides employed, the examination of stands, the characteristics of attack (the occurrence of which is not always obvious) and details of the method of spraying infested portions of standing trees are discussed. Only very limited treatment of felled ones is advocated. An emulsifiable preparation of BHC, used undiluted, was the only successful material tested, and it gave excellent kill of all stages in an average of 1–2 days (at 20–25°C. [68–77°F.]), without harming the trees. The spray apparatus used, which was fitted with extension rods, is described. Large-scale treatment was carried out in the autumn of 1953 and the following winter in many districts of Schleswig-Holstein, and assessment of the results in the two experimental localities showed that about 50 per cent. of the trees that would have had to be felled in 1953–54 were saved by the treatment. Further observations in one of the localities indicated that the numbers of trees felled in 1954–55 were very considerably lower than in previous years. The cost of treatment is discussed and supplementary cultural measures are outlined.

BRUNS (H.). **Untersuchungen und Beobachtungen an einer Naturkolonie der Roten Waldameise (*Formica rufa*) im Schadegebiet der Kl. Fichtenblattwespe (*Pristiphora abietina*).** [Investigations and observations on a natural colony of *F. rufa* in the outbreak area of *P. abietina*.]—*Z. angew. Ent.* **43** pt. 3 pp. 326–335, 6 figs., 11 refs. Hamburg, 1958. (With a summary in English.)

When nests of a large colony of the small form of *Formica rufa* L. in a forest containing spruce heavily infested by *Pristiphora abietina* (Christ) at Cloppenburg, near Oldenburg [cf. *R.A.E.*, A **48** 88], were protected from predators from the spring of 1952 onwards, which caused the ant population to increase for a time and then remain constant, the density of full sawfly cocoons in the soil within about 40 yards of each nest was found to vary with the distance from the nest throughout the outbreak of the sawfly (which ended in the summer of 1955), but bore no relation to it in the latent stage that followed.

ROMANYK (N.). **Die Nonne (*Lymantria monacha* L.) in Spanien.** [*L. monacha* in Spain.]—*Z. angew. Ent.* **43** pt. 3 pp. 336–338, 1 map. Hamburg, 1958. (With a summary in English.)

Outbreaks of *Lymantria monacha* (L.) on pine in Spain occurred in 1920, 1934–35 and 1950–51, and some 150,000 acres were affected in 1952–53 in three separate regions, one west of Soria, one east and south of Segovia and

one north-east of Cuenca, at heights of up to about 6,500 ft. *Pinus sylvestris* was the species principally affected, but *P. pinaster* was sometimes attacked in mixed stands. Defoliation of *P. sylvestris* was common during outbreaks, and many trees were killed. Widespread application of DDT dusts from aircraft in 1953-55 greatly reduced the area infested.

ZACHARIAE (G.). **Das Verhalten des Speisebohnenkäfers *Acanthoscelides obtectus* Say (Coleoptera: Bruchidae) im Freien in Norddeutschland.** [The behaviour of *A. obtectus* in the field in northern Germany.]—*Z. angew. Ent.* **43** pt. 4 pp. 345-365, 8 figs., 67 refs. Hamburg, 1959. (With a summary in English.)

Infestation of beans by *Acanthoscelides obtectus* (Say) in the field has occurred in central and northern Germany since the last war [*cf. R.A.E.*, A **41** 230]. Observations in Hamburg indicated that it results from the introduction of adults into the soil with the seed in spring, and investigations were therefore carried out in 1954-55 in which seeds infested with adults were sown and the behaviour of the beetles observed. Observations were also made in the laboratory. The following is based mainly on the author's summary of the results.

The adults left the beans as soon as the seed coats softened and were apparently unharmed, except when damp weather caused the seeds to rot. They came to the surface of the soil after some time and distributed themselves on a variety of plants in flower in the vicinity, feeding on the nectar of some and showing a preference for white or yellow flowers. They began to crawl, in sunshine, at 11°C. [51.8°F.] and became very active at 21°C. [69.8°F.] at 50-70 per cent. relative humidity. They flew only in sunshine, and the more actively the warmer and drier the air. Migration for a distance of about 100 yd. was observed. They congregated on bean plants as soon as the pods ripened, being apparently attracted by the scent of withering plant parts, and pairing and oviposition then occurred, 5-23 and an average of 13 eggs being laid per pod through holes gnawed by the females. Females laid an average of 60 eggs each in the laboratory. Early varieties were those most attacked, and the larvae completed their development in the stored beans.

ZOEBELEIN (G.). **Zur Beeinflussung der Insektenfauna des Waldes durch chemische Grossschädlingsbekämpfungen. 2. Mitteilung. Untersuchungen bei der Bekämpfung des Kiefernspanners (*Bupalus piniarius* L.) im oberbayrischen Forstamt Geisenfeld 1955.** [The effect of chemical control of major pests on the insect fauna of the forest. Second communication. Investigations during the control of *B. piniarius* in Geisenfeld, Upper Bavaria, in 1955.]—*Z. angew. Ent.* **43** pt. 4 pp. 432-438, 2 figs. Hamburg, 1959. (With a summary in English.)

In this second paper of a series [*cf. R.A.E.*, A **48** 155-156], a detailed account is given of investigations carried out in Bavaria in July-August 1955 on the effect of a 10 per cent. DDT aerosol, applied by the TIFA apparatus [*cf. 35* 259] at a rate of 0.72 lb. DDT per acre, on the insect fauna of a pine forest heavily infested by *Bupalus piniarius* (L.); infestation by Cecidomyiids, assumed from the damage caused to be *Thecodiplosis* (*Cecidomyia*) *brachyntera* (Schwaeg.) and *C. baeri* Prell, was also considerable. The treatment had to be carried out twice, at an interval of three days, because of bad weather, and counts showed that the numbers of beneficial,

indifferent and injurious insects killed were in the proportion 8:11:81, or, when the Cecidomyiids were excluded, 15:20:65. The increase in mortality of almost all groups of insects for two applications, as compared with one, was very noticeable. Counts of the crown fauna showed that mortality was nearly complete only for *B. piniarius*, the Cecidomyiids and Psocoptera, and that the other, mainly beneficial, groups generally regained their original numbers in 4-36 days.

KNÜLLE (W.). **Die Mehlmilbe (*Acarus siro* L.) und ihre Entwicklungsstadien.** [*Tyroglyphus farinae* and its developmental stages.]—*Z. angew. Ent.* **43** pt. 4 pp. 439-444, 8 figs., 1 ref. Hamburg, 1959. (With a summary in English.)

Figures, accompanied by a key, are given to facilitate identification of the mobile stages of *Tyroglyphus farinae* (Deg.) (*Acarus siro*, auct.), an important pest of stored grain.

BEHRENTZ (W.) & TECHNAU (G.). **Versuche zur Bekämpfung von *Anobium punctatum* mit Symbioticiden.** (Ein Beitrag zur experimentellen Symbioseforschung.) [Tests on the control of *A. punctatum* with symbioticides. (A contribution to the experimental investigation of symbiosis.)]—*Z. angew. Ent.* **44** pt. 1 pp. 22-28, 5 figs., 10 refs. Hamburg, 1959. (With a summary in English.)

The use of toxicants to eliminate symbionts of insects as a method of controlling the insects themselves is discussed. In tests to find a substance effective against the intracellular yeast symbionts that occur in the midgut of *Anobium punctatum* (Deg.) [*cf. R.A.E.*, A **47** 364], feeding by medium-sized larvae on wood impregnated with 2.6 oz. 4-aminobenzenesulphonamide per cu. ft. eliminated the symbionts in them in six months, and the larvae died after feeding for a further period.

FRÖHLICH (G.). **Zur Lebensweise und Entwicklung der Luzerneblütengallmücke *Contarinia medicaginis* Kieff.** [On the life-history and development of *C. medicaginis*.]—*Z. angew. Ent.* **44** pt. 1 pp. 29-41, 2 graphs, 30 refs. Hamburg, 1959. (With a summary in English.)

Investigations on the bionomics of *Contarinia medicaginis* Kieff. on lucerne were made in the field and laboratory near Leipzig in 1954-57 [*cf. R.A.E.*, A **49** 88], and the results are recorded in detail and compared with information in the literature. The following is based mainly on the author's summary of the work. More males than females emerged at the beginning of a flight period, but the ratio was later 1:1.5. The males remained on the lower parts of the plants, and pairing probably took place near the ground. Egg and larval development required 4-5 and about 24 days at an average daily maximum temperature of 20°C. [68°F.]. The full-fed larvae spun cocoons in the soil at depths of an inch or more and pupated, after about 4 days, immediately beneath the surface of the soil; the pupal stage lasted 10-12 days in summer. Pupation and emergence of many individuals of all generations was delayed, and some pupae passed two winters in the soil. Although the midge overwintered mostly in the pupal stage, it sometimes did so as a larva. There were three generations a year but four flight periods, these occurring in early June, the first half of July, the first half of August and late August and early September, respectively.

- MÜLLER (E. W.). **Untersuchungen zur Kontrolle des Massenwechsels von Obstbaumspeinnmilben.** [Investigations on the measurement of changes in the population of fruit-tree spider mites.]—*NachrBl. dtsh. PflSchDienst* (N.F.) **13** pt. 4 pp. 74–78, 8 figs., 22 refs. Berlin, 1959. (With summaries in Russian & English.)

Investigations in central Germany showed that populations of Tetranychids, including *Panonychus* (*Metatetranychus*) *ulmi* (Koch), on the leaves of fruit trees are best estimated by imprint recording [*R.A.E.*, A **30** 134], and the results obtained by the use of this method in 1958 are described.

- NOLTE (H. W.). **Über die Abhängigkeit der Wirkung von DDT- und HCH-Einstreumitteln gegen *Acanthoscelides obtectus* Say von der Temperatur.** [On the temperature dependence of the effect of DDT and BHC dusts on *A. obtectus*.]—*NachrBl. dtsh. PflSchDienst* (N.F.) **13** pt. 5 p. 94, 2 graphs, 2 refs. Berlin, 1959.

DDT and BHC dusts sometimes fail to give satisfactory control of *Acanthoscelides obtectus* (Say) in stored beans in Germany, and the tests described were carried out to ascertain whether temperature was responsible. Dusts were applied to petri dishes, adults were added, and mortality was observed at intervals for 62 hours at 5, 10, 12–13 and 19°C. [41, 50, 53.6–55.4 and 66.2°F.]. The lowest temperature at which mortality was satisfactory was 10°C. for BHC and 12–13°C. for DDT. It is noted that the beetles are inactive at low temperatures.

- NOLTE (H. W.). **Die Bekämpfung des Rapserdflohs (*Psylliodes chrysocephala* L.) und des Kohlgallenrüsslers (*Ceuthorrhynchus pleurostigma* Marsh.) durch Sameninkrustierung.** [The control of *P. chrysocephala* and *C. pleurostigma* by seed coatings.]—*NachrBl. dtsh. PflSchDienst* (N.F.) **13** pt. 8 pp. 153–157, 3 graphs, 9 refs. Berlin, 1959. (With summaries in Russian & English.)

Details are given of experiments in Germany in which various seed treatments with preparations of γ BHC protected rape against attack by *Psylliodes chrysocephala* (L.) and *Ceutorhynchus pleurostigma* (Marsham) and proved more effective than soil treatment at the time of sowing.

- HERFS (A.). **Über den Steinnussborkenkäfer *Coccotrypes dactyliperda* F.** [On the ivory-nut Scolytid, *C. dactyliperda*.]—*Anz. Schädlingssk.* **32** pt. 1 pp. 1–4, 9 figs., 3 refs. Berlin, 1959.

Coccotrypes dactyliperda (F.) infests the seeds of various palms and damages buttons made from them [*cf. R.A.E.*, A **48** 443]. In studies on its bionomics, which are recorded in detail, it also developed in the seeds of persimmon and to some extent in groundnuts, sweet almonds, hazel nuts [*Corylus avellana*] and, in one case, walnuts. The largest females were obtained from date seeds, from which up to 141 adults emerged per seed. Development was possible only at temperatures of 20–30°C. [68–86°F.] and relative humidities of 50–100 per cent. and lasted nine weeks at 20 and three at 30°C. Females greatly outnumbered males, and unfertilised ones gave rise to males only, after which they sometimes paired with them and then reproduced normally.

ACATAY (A.). *Phoracantha semipunctata* Fabr. (Col. Cerambycidae) in der Türkei. [*P. semipunctata* in Turkey.]—*Anz. Schädlingssk.* 32 pt. 1 pp. 4–5, 5 figs., 3 refs. Berlin, 1959.

An account is given of the damage caused to the trunks of felled *Eucalyptus* trees by *Phoracantha semipunctata* (F.) in the Mersin region of southern Turkey.

JANSSEN (M.). **Tortriciden in Rheinischen Obstanlagen.** [Tortricids in Rhineland orchards.]—*Anz. Schädlingssk.* 32 pt. 1 pp. 6–8, 1 fig., 30 refs. Berlin, 1959. (With a summary in English.)

Eight Tortricids in addition to *Argyroplote variegana* (Hb.) and *Spilota (Tmetocera) ocellana* (Schiff.) were observed infesting apple trees, and to a less extent pear and currant, in the Rhineland in 1952–54. *Adoxophyes orana* (Fisch. v. Roesl.) was by far the commonest. A key to the full-fed larvae of them is given, together with notes on the characters of the adults of most, a list of 17 Hymenopterous parasites reared from *Pandemis heparyana* (Schiff.) and information on the bionomics of the latter, which was found on apple and pear.

POSTNER (M.). **Zum Auftreten der Tannennadelgallmücke *Agevillea abietis* Hubault (Cecid. Dipt.) in Süddeutschland.** [On the occurrence of the fir-needle gall-midge, *A. abietis*, in South Germany.]—*Anz. Schädlingssk.* 32 pt. 2 pp. 23–26, 1 fig., 21 refs. Berlin, 1959.

The Cecidomyiid, *Agevillea abietis* Hubault [cf. *R.A.E.*, A 34 214], has been observed on fir [*Abies*] in southern Germany since 1954 and has caused local damage to trees up to 15 years old at altitudes below about 1,600 ft.

AUERSCH (O.). **Zum Auftreten des Apfelschalenwicklers (*Adoxophyes reticulana* Hb.) 1958 im Gebiet von Halle/S.** [On the occurrence of *A. orana* in 1958 in the region of Halle.]—*Anz. Schädlingssk.* 32 pt. 4 pp. 53–57, 9 figs., 3 refs. Berlin, 1959.

Adoxophyes orana (Fisch. v. Roesl.) (*reticulana* (Hb.)) has been injurious to apple in central Germany since 1956 and caused considerable damage to apple and pear near Halle in 1958. The bionomics of the Tortricid and the injury that it causes to the fruits are described, and its control is reviewed.

WACHTENDORF (W.). **Bemerkungen zur Lebensweise und Bekämpfung des Kiefertriebwicklers *Evetria (Rhyacionia) buoliana* Schiff.** [Remarks on the mode of life and control of the pine shoot moth (*Rhyacionia buoliana*).]—*Anz. Schädlingssk.* 32 pt. 4 pp. 59–61, 8 refs. Berlin, 1959.

Rhyacionia (Evetria) buoliana (Schiff.) was injurious to pines in Bavaria in 1950–53, after which the outbreak was terminated by winter cold and to some extent by parasites. The main centres of infestation were on poor soil. In tests on control, emulsion sprays of 0.5–1 per cent. trichlorphon (Dipterex) proved toxic to the larvae and better than demeton (Systox) or methyl-demeton (Metasystox).

ACATAY (A.). *Melanophila decastigma* (= *picta* Pall.) und *Gypsonoma* (= *Semasia*) *dealbana* Froel. (= *incarnana* Hw.) in der Türkei. [*M. picta* and *G. dealbana* in Turkey.]—*Anz. Schädlingssk.* 32 pt. 5 pp. 65–68, 7 figs., 4 refs. Berlin, 1959.

Notes are given on the bionomics of *Melanophila picta* (Pall.) (*decastigma* (F.)) and *Gypsonoma dealbana* (Froel.), which were found damaging young poplars in nurseries in Turkey.

DÄSSLER (H. G.) & HENKER (W.). Über Lockstoffe beim grossen Kiefern-borkenkäfer (*Ips sexdentatus*). [On attractants for *I. sexdentatus*.]—*Anz. Schädlingssk.* 32 pt. 5 pp. 74–76, 10 refs. Berlin, 1959.

The following is based on the authors' summary. Laboratory experiments are recorded in which various chemicals were tested for their attractiveness to *Ips sexdentatus* (Boern.). Propionaldehyde at a dilution of 10^{-2} proved the best of the aldehydes tested; acetone was just as good. Dipentene and camphene were strongly attractive, and saturated and unsaturated fatty-acid esters had little effect.

SCHAEFFENBERG (B.). *Beauveria bassiana* (Vuill.) Link als Parasit des Kartoffelkäfers (*Leptinotarsa decemlineata* Say). II. Infektionsversuche im Freiland an L_2 - und L_3 -Larven. [*B. bassiana* as a parasite of *L. decemlineata*. II. Field tests with second- and third-instar larvae.]—*Anz. Schädlingssk.* 32 pt. 6 pp. 87–90, 3 figs., 15 refs. Berlin, 1959.

In this second paper of a series [cf. *R.A.E.*, A 46 279], details are given of field experiments in Germany in which dusts prepared from the spores of *Beauveria bassiana* were applied to second- and third-instar larvae of *Leptinotarsa decemlineata* (Say) on potato. It was found that susceptibility to the fungus was in inverse relation to the age of the larvae and that death occurred 8–12 days sooner in larvae in these instars than in the case with fourth-stage individuals. The virulence of the fungus was increased by culturing on a nutritive substrate, was maintained at the high level for 16 generations and fell to about half after 30 generations. The conidia retained their viability after storage for 2–3 years in cool dry conditions.

SCHULTZE-DEWITZ (G.). Zur Biologie von *Phyllopertha horticola* L. [On the bionomics of *Anomala horticola*.]—*Anz. Schädlingssk.* 32 pt. 6 pp. 91–93, 4 figs., 26 refs. Berlin, 1959.

Field and laboratory observations on the bionomics of *Anomala* (*Phyllopertha*) *horticola* (L.) [cf. *R.A.E.*, A 48 431, etc.] were made in central Germany in 1951–52, and the following is based on the author's summary of the results. There is only one generation a year, and the adults emerge from the soil at the beginning of June. Flight occurs on warm days between 8.30 and 11 a.m. The eggs are laid in two batches, with an interval of 2–3 days, some 25 being laid in all at a depth of 10 in. in the soil. The eggs hatch in 12–14 days, and the three larval instars last 28 days, 25–28 days and 8–8.5 months, respectively, winter being passed in the third instar. Feeding is continued in spring, and pupation occurs in mid-May; the pupal stage lasts only 14 days.

RÖMER (D.). **Hostatox, ein Insektizid mit grosser Wirkungsbreite.** [Hostatox, an insecticide with a wide range of effectiveness.]—*Pflanzenschutz* **10** no. 6 pp. 79–82, 30 refs. Munich, 1958.

Hostatox consists of a mixture of polychloroendomethylenetetrahydroindenes [cf. *R.A.E.*, A **48** 341] and is available in Germany as an emulsion concentrate (Illoxol), a spray powder and a dust (Illoxan). All three have rather less initial effect than corresponding BHC preparations, but have long-lasting action. Effectiveness increases with temperature, though this has no influence on rapidity of action, and toxicity at low temperatures is considerable, which, together with its high vapour pressure, renders Hostatox suitable for use against soil pests. It has some penetrative effect, which enables it to control mining insects, can be mixed with many other modern insecticides and fungicides, is harmless to plants, does not taint foodstuffs and is not particularly toxic to man or domestic animals, but it is toxic to bees and fish. Examples of its use and a list of insects and mites against which it is effective are given.

SCHERNEY (F.). **Über die Wirkung verschiedener Insektizide auf Laufkäfer (Col. Carabidae).** [On the effect of various insecticides on Carabids.]—*Pflanzenschutz* **10** no. 7 pp. 87–92, 5 refs. Munich, 1958.

Observations in southern Germany in 1954 showed that the use of insecticides against *Leptinotarsa decemlineata* (Say) on potato led to considerable temporary reductions in the field population of predacious Carabids. In tests, the most toxic was parathion; toxaphene had much less effect.

BOLLOW (H.). **Der Schattenwickler (*Cnephasia wahlbomiana* L.) in Bayern.** [*C. virgaureana* in Bavaria.]—*Pflanzenschutz* **10** no. 8 pp. 91–93. Munich, 1958.

Cnephasia virgaureana (Treitschke) (*wahlbomiana*, auct.) did not attract much attention in Bavaria until 1954, when it attacked clover and lucerne [cf. *R.A.E.*, A **49** 87]. Infestation was widespread in 1957 and 1958. The bionomics, food-plants and control of the Tortricid are reviewed.

THIEM (H.) & SCHETTERS (C.). **Die Vermehrung der San-José-Schildlaus (*Aspidiotus perniciosus* Comst.) in Abhängigkeit vom Zustand der Wirtspflanzen und der Stärke ihrer Erstbesiedelung.** [The increase of *Quadraspidiotus perniciosus* in relation to the state of its food-plants and the density of the initial infestation.]—*Pflanzenschutz* **10** no. 12 pp. 138–142, 5 refs. Munich, 1958.

Quadraspidiotus (Aspidiotus) perniciosus (Comst.) is polyphagous, and it has not proved easy to classify its food-plants according to the degree of attack [cf. *R.A.E.*, A **43** 98; **46** 395]. Observations are recorded on the extent to which reproduction occurred on various young shade trees and shrubs in an infested greenhouse in Heidelberg in 1953. The crawlers find suitable sites for settling by wandering at random, and, since not all parts of all plants are equally favourable, successful colonisation of some species depended on the size of the initial colony; the critical colony size varied for different plant species.

MOERICKE (V.). **Über ein Auftreten des Pflaumenwicklers (*Laspeyresia funebrana* (Tr.)) in Sauerkirschen.** [An occurrence of *Cydia funebrana* on sour cherries.]—*Z. PflKrankh.* **67** pt. 1 pp. 1-7, 9 figs., 12 refs. Stuttgart, 1960. (With a summary in English.)

Cydia (Laspeyresia) funebrana (Treitschke) is recorded infesting young fruits of sour cherry (*Prunus cerasus*) near Bonn. The damage, which was severe in 1958 and 1959, is described.

JANSSEN (M.). **Beitrag zur Kenntnis der Parasiten von *Apanteles glomeratus* L.** [A contribution to knowledge of the parasites of *A. glomeratus*.]—*Z. PflKrankh.* **67** pt. 1 pp. 19-24, 3 refs. Stuttgart, 1960. (With a summary in English.)

Cocoons of *Apanteles glomeratus* (L.), which parasitises *Pieris brassicae* (L.), were collected in western Germany and Denmark in the autumn of 1955 and kept for emergence of parasites of the Braconid. A list is given of 13 Hymenoptera that emerged, of which the commonest in both countries was *Haplaspis (Hemiteles) nanus* (Grav.). Parasitism of the cocoons was lower in Denmark than in Germany, where it reached 82 per cent. in the Rhineland.

KANERVO (V.). **Tuloksia juurimatojen torjuntakokeista.** [The control of wireworms.]—*Maatalous ja Koetoim.* **13** pp. 17-26, 1 fig. Helsinki, 1959. (With a summary in English.)

Tests in 1948 in southern Finland on the control of wireworms (*Agriotes obscurus* (L.) and *A. lineatus* (L.)) infesting oats showed that raking a 0.46 per cent. BHC dust into the soil two days before sowing, at a rate of 135-180 lb. per acre, gave good protection; a 5 per cent. DDT dust at 135 lb. was also effective, but its action was slower. Trials in 1948-58 showed that γ BHC seed dressings gave good control on both cereals and sugar-beet, but had an injurious effect on germination and growth of seedlings under certain conditions. Seed treatment with aldrin also gave good control, especially on cereals.

VARIS (A. L.). **Juurikaskärpäsen torjunrasta.** [Control of the mangold fly.]—*Maatalous ja Koetoim.* **13** pp. 64-71, 2 figs., 7 refs. Helsinki, 1959. (With a summary in English.)

Three field tests were carried out in 1958 in southern Finland with endrin, parathion and trichlorphon (Dipterex) for the control of the larvae of *Pegomyia betae* (Curt.), mining the leaves of sugar-beet. The first took place on 30th June, when there was an average of 33 eggs per plant, of which 44 per cent. were unhatched. The plants in their six-leaf stage were sprayed with 0.2 per cent. endrin, 0.1 per cent. parathion or 0.5 per cent. trichlorphon; the insecticides proved equally effective, increasing the yield of roots and sugar by 20 and 20-25 per cent., respectively. In the second test, on 4th July, the three materials at 0.05, 0.02 and 0.1 per cent., respectively, killed 100, 96 and 100 per cent. of the larvae, and a 1.5 per cent. parathion dust was practically ineffective at 0.9 lb. per acre, but gave complete control at 18-22.5 lb. In the third test, on 9th September, when the temperature

was -8.3°C . [17.1°F .], the plants were sprayed with 0.1 per cent. trichlorophon against larvae of the second generation. Heavy frost rendered the effect uncertain, but treated plants showed better growth than untreated ones.

TIITTANEN (K.). **Kahukärpäsen torjuntakokeissa syysrukiilla saatuja tuloksia.** [Control of the frit fly on winter rye.]—*Maatalous ja Koetoim.* **13** pp. 110–116. Helsinki, 1959. (With a summary in English.)

In southern Finland, *Oscinella frit* (L.) causes serious damage to winter rye sown before 20th August. In field tests in 1956–58, seed treatment with aldrin, lindane [almost pure γ BHC] and phorate (Thimet-44) gave no control and retarded the growth of the seedlings. A spray of parathion at 0.028 per cent. gave good control, whereas 0.025 per cent. demeton, 0.15 per cent. malathion and 0.1 per cent. methyl-demeton proved unsatisfactory. The best result was given by spraying with parathion immediately after oviposition (usually 2–3 days after seedling emergence); a second application, one week later, was beneficial.

FJELDDALEN (J.), AUSLAND (O.) & RYGG (T.). **Purremøll et nytt skadedyr på løk og purre.** [The leek moth, a new pest of onions and leeks.]—*Gartneryrket* **50** no. 21 pp. 448–451, 8 figs., 6 refs. Oslo, 1960. (With a summary in English.)

Acrolepia assectella (Zell.) has been present in Norway for some years, but did not prove injurious until 1957–59 when onions, leeks and chives were attacked in many districts. Observations on the bionomics of the moth are recorded; there were two generations a year, and most of the injury was due to larvae of the second, occurring in August–September. Development was completed in the stored onions, and adults were present in the store-houses throughout the winter.

NAGY (B.). **Gyümölcsdarazsak (*Hoplocampa* spp.).** [Fruit sawflies (*Hoplocampa* spp.).]—152 pp., 72 figs., $7\frac{1}{2}$ pp. refs. Budapest, Mezőgazd. Kiadó, 1960. (With a summary in German.)

The main species of *Hoplocampa* of importance in Hungary are *H. minuta* (Christ) and *H. flava* (L.) on plum [cf. *R.A.E.*, A **48** 551], *H. brevis* (Klug) on pear and *H. testudinca* (Klug) on apple. In this booklet, the author summarises information on their distribution, morphology, bionomics, ecology and control, giving a key to the adults and a general account of the importance of the genus.

MATHYS (G.). **Vers un tournant dans la lutte contre le pou de San-José?—***Rev. rom. Agric.* **15** no. 6 pp. 53–56, 4 figs., 3 refs. Lausanne, 1959.

Control measures applied during the past ten years against *Quadraspidiotus perniciosus* (Comst.) on fruit trees in Switzerland have resulted in apparent eradication of the Coccid from the cantons of Geneva, Neuchâtel and Vaud and considerable reduction of the infested areas in the Valais and Ticino. Since further progress in the last two cantons seemed problematical, *Prospaltella perniciosi* Tower, which parasitises *Q. perniciosus*, was introduced from various sources, reared in the laboratory and released in orchards in 1958. Preliminary observations showed that the parasite overwintered successfully in both areas.

- BLETCHLY (J. D.). **The influence of soft rot on the susceptibility of beech to attack by the common furniture beetle** (*Anobium punctatum* Deg.).—*Rec. annu. Conv. Brit. Wood Preserv. Ass.* 9 pp. 5-30, 1 graph, 10 refs. London, 1959.

Experiments are described indicating that the presence of soft rot (*Chaetomium globosum*) increases the susceptibility of beech wood to infestation by *Anobium punctatum* (Deg.) by facilitating establishment of the larvae and increasing their rate of development [cf. *R.A.E.*, A 41 231].

- STRINGER (J. M.). **Nut leaf weevil, *Strophosomus*, and related species defoliating Japanese azaleas.**—*J. R. hort. Soc.* 84 pt. 7 pp. 332-333. London, 1959.

The author reports that varieties of *Rhododendron obtusum*, growing in southern England at the edge of a mixed wood of beech and oak and near plants of *Calluna vulgaris*, showed leaf injury in May and had been defoliated by October; the stem epidermis was extensively scarred, and other varieties of Japanese azalea also showed signs of attack. Weevils, mainly *Strophosomus melanogrammus* (Först.), with *S. capitatus* (Deg.) and small numbers of *S. sus* Steph., were responsible; the first two normally attack oak, hazel and birch and the last *Calluna*. A DDT spray gave complete control.

- HUSSEY (N. W.), PARR (W. J.) & GURNEY (B.). **The effect of white-fly populations on the cropping of tomatoes.**—*Rep. Glasshouse Crops Res. Inst.* 1958 pp. 79-86, 2 graphs, 2 refs. Littlehampton, 1959.

The following is based on the conclusions drawn by the authors from the experiments described, which were carried out on tomato in the greenhouse in southern England. It is evident from the copious production of honeydew by the later instars of *Trialeurodes vaporariorum* (Westw.) that even light infestations will result, under moist conditions, in the development of some sooty mould. Reduction in crop yield, however, is not to be expected until the attack has reached moderate proportions, of some 70 individuals per $\frac{3}{4}$ -inch disk, at which population level about 70 per cent. of the fruit picked was free from mould. Heavier infestations (130 per disk) further reduced the yield, and the amount of clean fruit fell sharply to about 13 per cent. While the presence of this mould does not appreciably impair the quality of the fruit, except perhaps in very heavy infestations, it makes it necessary to clean it before marketing, which is laborious and time-consuming. There is some evidence to suggest that heavy infestations on young plants may subsequently have an adverse effect on the setting of the fruit if allowed to go unchecked. The height growth of infested plants is not impaired unless initial infestation occurs when the seedlings are very small. In experiments on the biological control of *T. vaporariorum*, it is apparent that the steady density about which the population should fluctuate should not exceed a mean of 20 per $\frac{3}{4}$ -inch disk on the upper leaflets throughout the life of the plant.

- ANGELINI (A.). **Note préliminaire sur la recherche de caractères de résistance à *Platyedra gossypiella*.**—*Cot. et Fibr. trop.* 14 fasc. 1 pp. 51-56, 3 refs. Paris, 1959. (With a summary in English.)

Pectinophora (*Platyedra*) *gossypiella* (Saund.) is one of the most important pests of cotton in the Ivory Coast. The author describes investigations on

the entry of the young larvae into the bolls, with the effects on it of oil glands, internal boll reactions and hardness of the endocarp, and notes differences in the susceptibility of different species and varieties of cotton. The presence of bracts greatly increased the amount of oviposition and puncturing of the bolls.

FENNAH (R. G.). **A new Dexiine parasite of *Tragocephala* from West Africa (Diptera; Tachinidae).**—*Ann. Mag. nat. Hist.* (13) **1** (1958) no. 10 pp. 682–684, 1 fig. London, 1959.

Billaea vanemdeni, sp. n., is described from adults of both sexes reared in 1958 from *Tragocephala nobilis* (F.) at Tafo, Ghana. The pupal stage was stated to occupy 24 days.

JONES (T.). **The major insect pests of timber and lumber in West Africa.**—*Tech. Bull. W. Afr. Timb. Borer Res. Unit* no. 1, 20 pp., frontis., 10 pls., 8 refs. London, 1959. **Ambrosia beetles (Scolytoidea) their biology and control in West Africa.**—*Op. cit.* no. 2, 14 pp., 6 pls., 8 refs.

ROBERTS (H.). *Trachyostus ghanaensis* Schedl (Col., Platypodidae), an ambrosia beetle attacking wawa, *Triplochiton scleroxylon* K. Schum.—*Op. cit.* no. 3, 17 pp., frontis., 5 pls. (1 fldg.), 5 figs., 2 refs. 1960.

These bulletins are based on the results of investigations by the West African Timber Borer Research Unit in Ghana and Nigeria [*cf. R.A.E.*, A **47** 397, etc.] and are intended to acquaint producers and users with the main types of insect damage to timber in those countries, the habits of the insects concerned and measures for the prevention and control of infestation. The first deals with ambrosia beetles (Platypodids and Scolytids), Longicorns and powder-post beetles (Bostrychids and Lyctids), the second in more detail with ambrosia beetles, and the third with the bionomics of *Trachyostus ghanaensis* Schedl, a shot-hole borer that damages *Triplochiton scleroxylon* in Ghana and causes down-grading of the timber, though it does not reduce tree growth.

BENNETT (C. W.) & TANRISEVER (A.). **Curly top disease in Turkey and its relationship to curly top in North America.**—*J. Amer. Soc. Sug. Beet Tech.* **10** no. 3 pp. 189–211, 5 figs., 20 refs. Fort Collins, Colo., 1958.

The following is based on the author's summary. Sugar-beet plants were found in 1955 near Eskişehir, Turkey, with symptoms typical of curly top as it is known in the United States. The disease was found again in 1956, and a survey in 1957 showed that it was present in at least seven widely separated localities, the percentage of infection reaching 32 in some fields. Virus recovered in California from dried leaves received from Turkey was readily transmitted by *Circulifer tenellus* (Baker), which retained it for up to 49 days. In tests in Turkey, the virus was transmitted from infected to healthy sugar-beet by *C. opacipennis* (Leth.), but not by *Empoasca decipiens* Paoli or *Myzus persicae* (Sulz.). In tests on its other properties, the virus proved to have much the same host-plant range in Turkey as in the United States, and varieties of sugar-beet differed similarly in susceptibility to it in the two countries. The evidence indicates that the virus originated in the Mediterranean area [but *cf. R.A.E.*, A **44** 174] and was probably introduced into North America with its vector, *C. tenellus*. The relation to it of the curly-top virus of South America [*cf. 34* 379; **40** 384] remains obscure.

PAGDEN (H. T.). *Patanga succincta* (L.), the "Bombay locust", in Malaya.—*Bull. Dep. Agric. Malaya* no. 106, [1 +] iii + 31 pp., 14 pls., 4 fldg. tables, 4 refs. Kuala Lumpur, 1959.

Patanga succincta (L.) is a large grasshopper that occurs in Malaya and sometimes swarms in the adult stage. It is doubtful whether swarms migrate, and dense migratory bands of hoppers are unknown. It sometimes damages crops, but its importance in this respect has been exaggerated. The author reviews records of solitary individuals and swarms in Malaya, describes all stages and the bionomics of the grasshopper and reviews recent work on its control. Moistened baits of rice bran with 4 per cent. Paris green proved effective, and a spray affording 8 lb. 0.65 per cent. γ BHC per acre killed many hoppers but proved repellent to the adults, driving them away to other areas.

PAPERS NOTICED BY TITLE ONLY.

HEDLIN (A. F.). **Description and habits of a new species of *Phytophaga* [*thujac*, sp. n.] (Diptera: Cecidomyiidae) from western red cedar [*Thuja plicata*] cones** [in British Columbia].—*Canad. Ent.* **91** no. 11 pp. 719–723, 15 figs., 4 refs. Ottawa, 1959.

CLARK (R. C.) & BROWN (N. R.). **A field cage for rearing Syrphid larvae and other predators of the balsam woolly aphid, *Adelges* [*Chermes*] *piceae* (Ratz.) (Homoptera: Adelgidae).**—*Canad. Ent.* **91** no. 11 pp. 723–725, 3 figs. Ottawa, 1959.

KHALIFA (A.). **Die wichtigsten Probleme der angewandten Entomologie im Sudan.** [The most important problems of applied entomology in the Sudan (a review article).]—*Anz. Schädlingssk.* **32** pt. 4 pp. 49–52, 1 map, 19 refs. Berlin, 1959.

WOOD (S. L.). **Insects of Micronesia. Vol. 18 no. 1. Coleoptera: Platypodidae and Scolytidae.**—pp. [3 +] 1–73, 13 figs., 1 map. Honolulu, Bishop Mus., 1960. [Cf. *R.A.E.*, A **43** 345; **49** 156, etc.]

KNOCH (C.). **Vergleichende Untersuchungen über den Nahrungswert verschiedener Häute- und Fellsorten für die Larven verschiedener Speckkäfer- (*Dermestes*-) Arten.** [Comparative investigations on the food value of different hides and skins for the larvae of *Dermestes* spp.]—*Ent. Mitt. zool. Staatsinst. Hamburg* no. 22, 18 pp., 1 fig., 17 refs. Hamburg, 1959.

KÖRTING (A.). **Biologische Untersuchungen über die Entwicklung von *Hylotrupes bajulus* L. (Hausbockkäfer).** [Biological investigations on the development of *H. bajulus*.]—*Mitt. biol. Bundesanst. Berl.* pt. 96, 35 pp., 7 figs., 23 refs. Berlin, 1959.

CHARARAS (C.). **Relations entre la pression osmotique des conifères et leur attaque par les Scolytidae.**—*Rev. Path. vég.* **38** fasc. 4 pp. 215–233, 5 figs., 10 refs. Paris, 1959. (With a summary in German.)

GIBBS (A. J.) & GOWER (J. C.). **The use of a multiple-transfer method in plant virus transmission studies [including work with aphids]—some statistical points arising in the analysis of results.**—*Ann. appl. Biol.* **48** no. 1 pp. 75–83, 3 graphs, 8 refs. London, 1960.

THE INSECT PESTS OF COTTON IN TROPICAL AFRICA

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